Braking System 12

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GENERAL DESCRIPTION

The Transit braking system is hydraulically operated on all front and rear wheels with a dual line system to provide separate hydraulic circuits for front disc and rear drum brakes. Should one circuit fail the other circuit is unaffected and the vehicle can be brought to a halt. The hydraulic pressure is applied from the master cylnder to each operating cylinder through metal bundy pipes with flexible hoses at each wheel to compensate for suspension and steering movements.

The hydraulic system is split, either between the front and rear brakes, known as 'vertically split', Figs.1 & 2, or with the rear brakes and the lower of the two pistons in the four piston caliper as one circuit and the upper two pistons in the caliper as the other circuit. This system is known as 'horizontally split', Fig.3.

The front calipers are either two or four piston design depending on model variants and territorial requirements, the calipers operate on 269,7mm (10,62in) solid or ventilated cast iron discs. The calipers are self-adjusting during operation of the brake pedal.

Each rear brake utilises one leading and one trailing shoe operated by a double acting cylinder on each wheel brake assembly. The linings are bonded to the brake shoes, the leading shoe being approximately twice as thick as that of the trailing shoe. This allows for the greater rate of wear on the leading shoe and ensures that both linings have similar service life.

Both front and rear brakes are self-adjusting during normal operation of the foot brake pedal. The handbrake mechanism is mechanically operated with a lever mounted between the front seats, operating an adjustable primary rod through a yoke and nylon cable to operate the mechanism in the rear brake assemblies.

To reduce pedal effort a brake servo unit of the suspended vacuum type is fitted between the brake pedal and master cylinder. Should the servo unit fail the push rod still acts mechanically to provide non-servo assisted braking.

A pressure delay valve is fitted into the front brake hydraulic circuit, to optimise brake performance during light braking application. This allows rear brake hydraulic pressure to be higher in this condition.

Dependent on territorial requirements, a load apportioning valve (L.A.V.) is fitted to the rear brake circuit minimising the possibility of early 'lock up' of the rear wheels under heavy or emergency braking conditions with the vehicle in an unladen or partly laden condition.

IMPORTANT NOTES:

- Brake system components must be kept clean of any foreign matter. If necessary any hydraulic component should be washed in clean brake fluid, industrial alcohol or methylated spirits to remove any foreign matter and dried with a clean non-fluffy cloth. Do not use a mineral base fluid such as petrol, paraffin, etc.

  Brake fluid must not be allowed to come into contact with brake pads/shoes or with disc or drum surfaces. Industrial alcohol or methylated spirits must be used to flush out the system and for washing fluid from disc or drum surfaces.

  Ensure that sealing lips are perfectly formed, concentric with the bore of the seal, free from knife edges, surface blemishes or marks. Any seal that is not perfect should be rejected. Seals should not be turned inside out when inspecting them, since this strains the surface skin and may eventually lead to failure. All pistons and housings must be carefully inspected before assembly. Any imperfections or scores on a piston or cylinder bore may provide a track for fluid leaks under pressure and any damaged parts must be renewed. Parts must be handled carefully to prevent any accidental scoring. Prior to assembly immerse hydraulic components in clean brake fluid to provide initial lubrication for working surfaces. Due to the complexity of braking systems, when renewing or overhauling component, care must be taken to ensure that only correct parts are fitted.

  Any brake fluid accidentally spilt onto a painted surface must be cleaned off immediately using cold water to prevent damage to paintwork.

- Asbestos dust when inhaled can be injurious to health. Do not blow out dust with an airline. A vacuum cleaner, brush or rag should be carefully used to remove any dust. Any dust should be contained in a sealed bag for disposal.

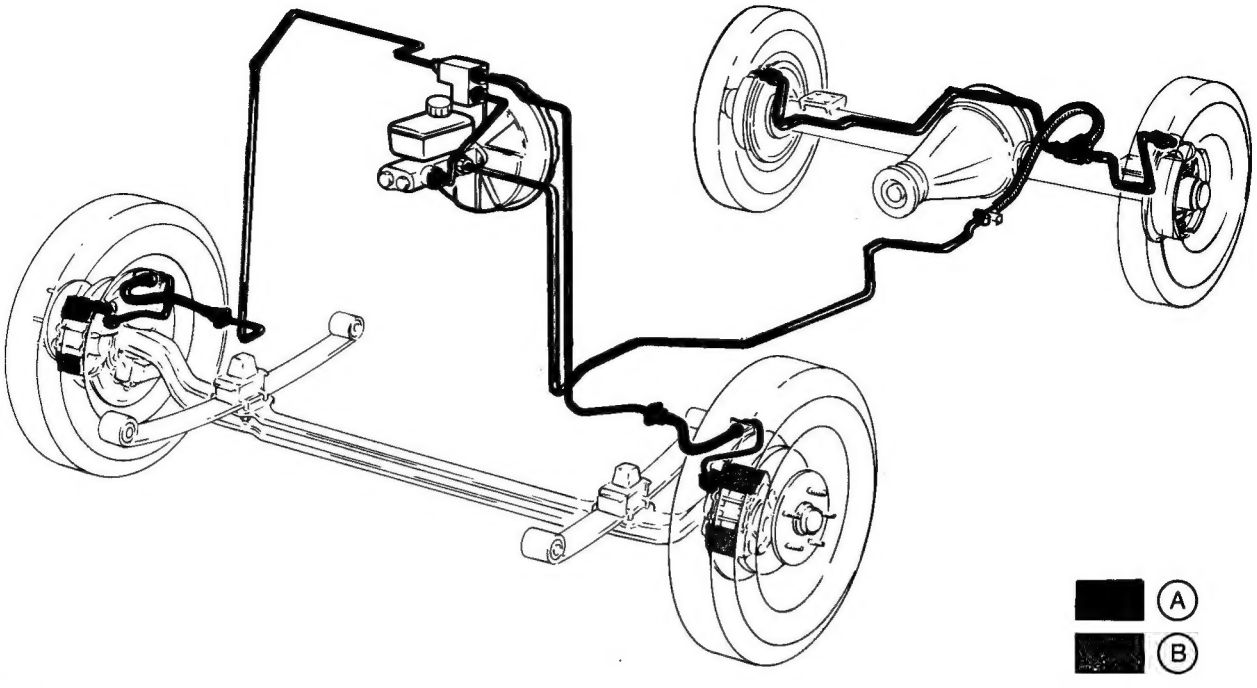

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Fig.1. Vertical Split Braking System (LCX).
A - Rear brake circuit
B - Front brake circuit

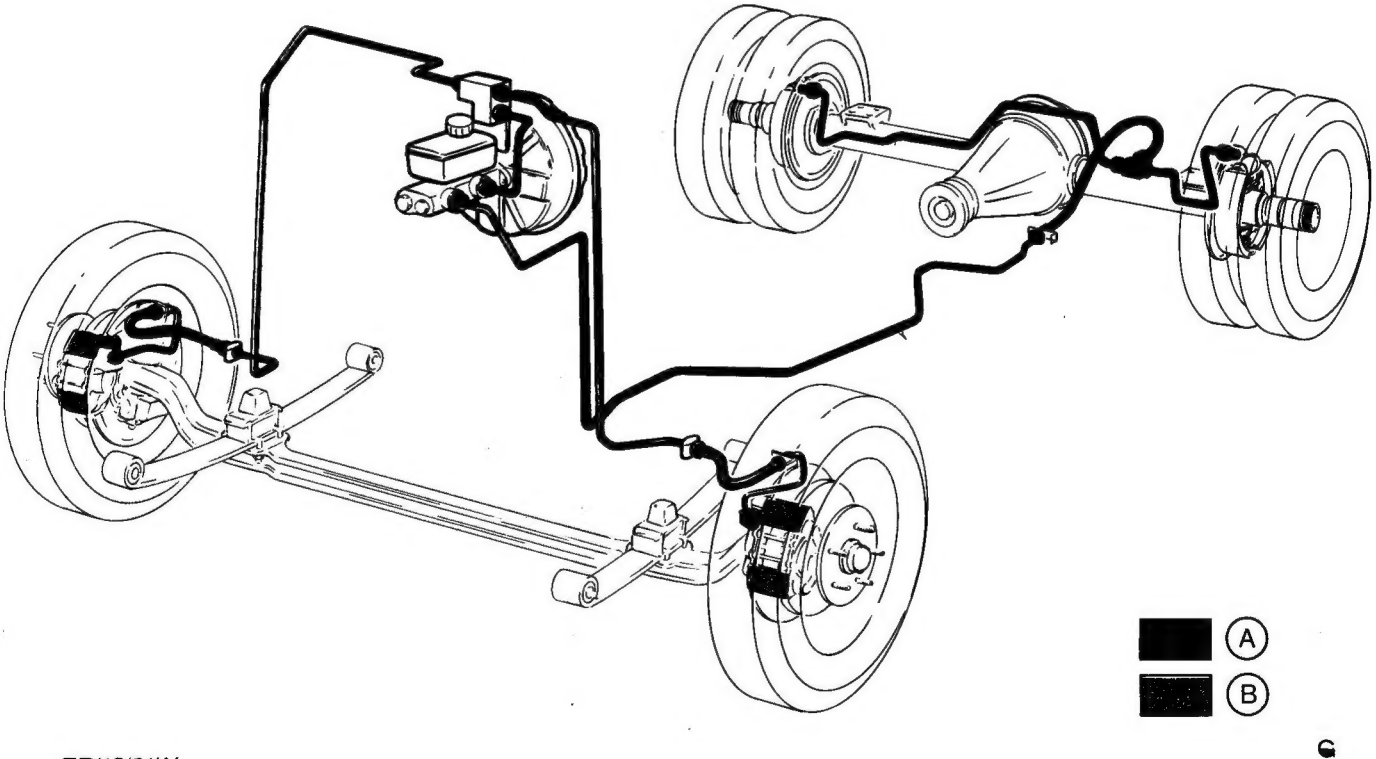

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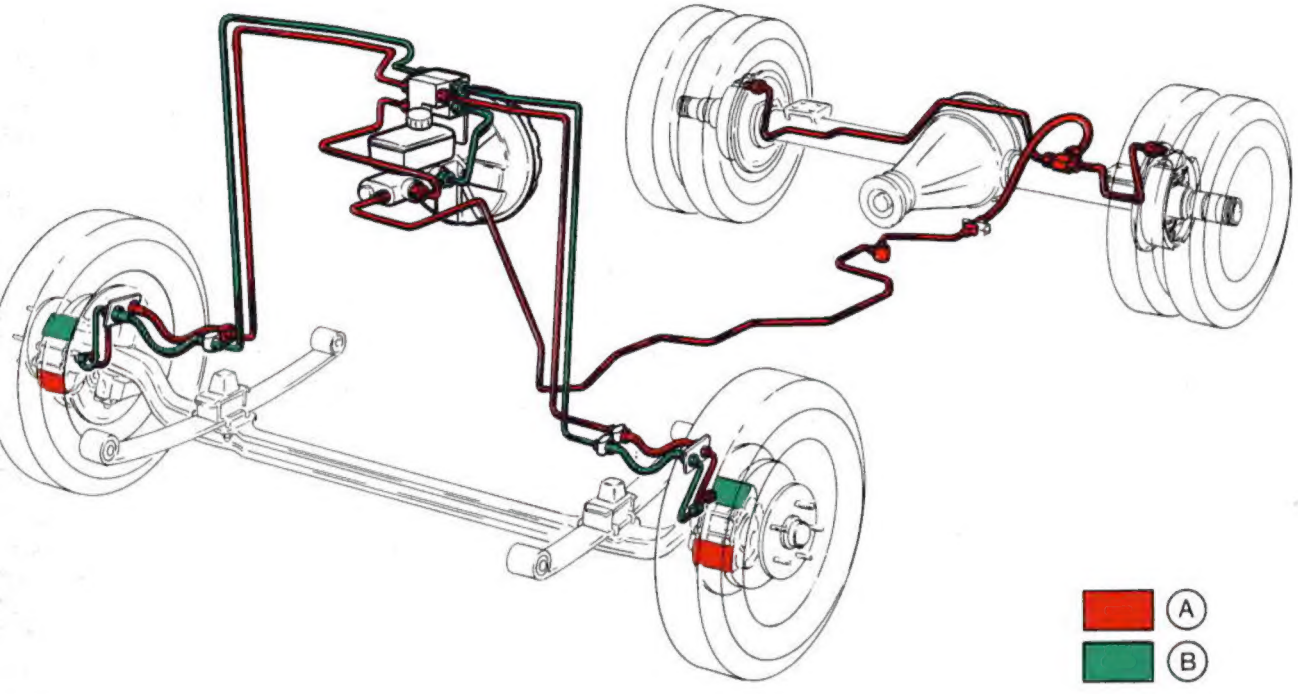
Fig.2. Vertical Split Braking System (LCY).
A - Rear brake circuit
B - Front brake circuit



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3. Horizontal Split Braking System.
   A - Rear brake and lower front brake caliper circuit
   B - Upper front brake caliper circuit

Master Cylinder

The master cylinder is operated by the brake pedal and is a tandem type to provide separate braking circuits. Transits equipped with the vertically split systems have two sizes of master cylinder fitted. Variants with 23,8 mm (0,937 in) internal diameter cylinder have the primary chamber feeding the front brakes, and the secondary, the rear brakes, Fig.4. Variants fitted with the 22,2mm (0,875 in) master cylinder have the ports reversed.

For vehicles with horizontal split braking systems, the secondary chamber provides fluid pressure to the rear brakes, and the lower caliper chamber of the four piston calipers and the primary chamber provides fluid pressure to the upper pistons of the four piston caliper only. The primary chamber is identified as the port nearest cylinder mounting flange.

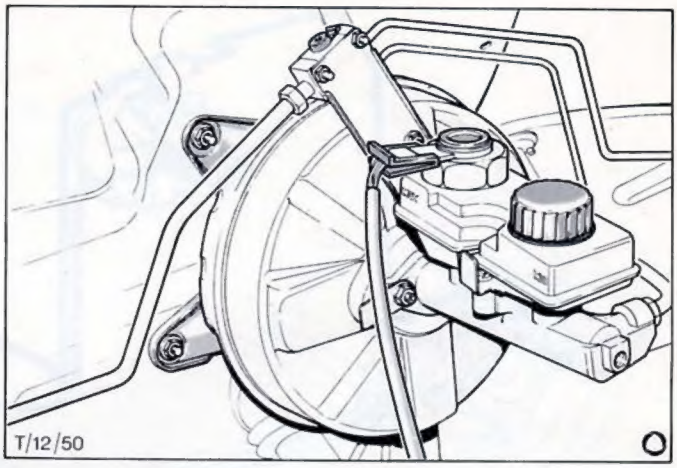

Fig.4. Master cylinder and servo assembly.

The brake fluid is housed in a semi-transparent reservoir which contains a separation baffle. The baffle ensures that, in the event of a fluid leak in one circuit, fluid is still available to operate the other.

Operation of the foot brake causes the master cylinder pistons to be pushed along the bore against the fluid. As brake fluid is incompressible, movement is transmitted along the length of the brake pipes. The total master cylinder displacement is divided between the split braking circuits.

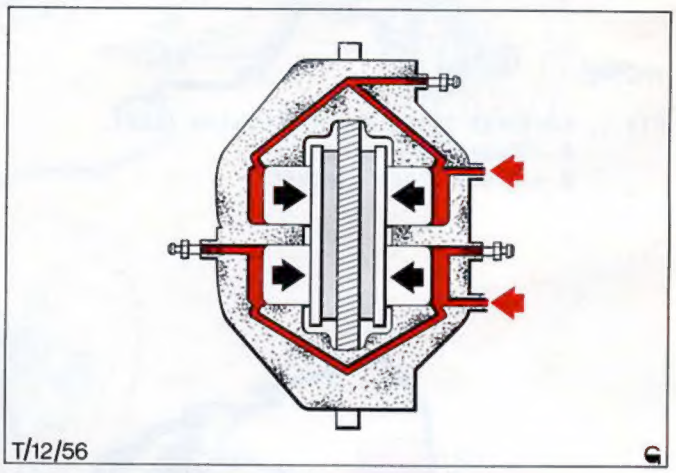

Fig.5. Four piston caliper operation.

Front Disc and Caliper Assemblies

Each front brake is actuated by fluid pressure pushing the pistons against the brake pads, causing them to come into firm contact with the brake discs. When the brake pedal is released the piston is withdrawn a small distance by the piston seal shape. As the pads wear, the piston moves out further than it is retracted by the seal, thus the brake self adjusts. Fig.5.

Rear Drum Brake

The rear drum brake is actuated by the fluid pressure causing the pistons in the wheel cylinder bore to expand the brake shoes until they come into contact with the brake drum.

The rear brakes are self adjusting during operation of the brake pedal.

The self adjusting mechanism consists of a spacer strut and a pair of toothed ratchets. The spacer strut is attached to the trailing shoe and the adjusting ratchets are attached to the leading shoe. Fig.6.

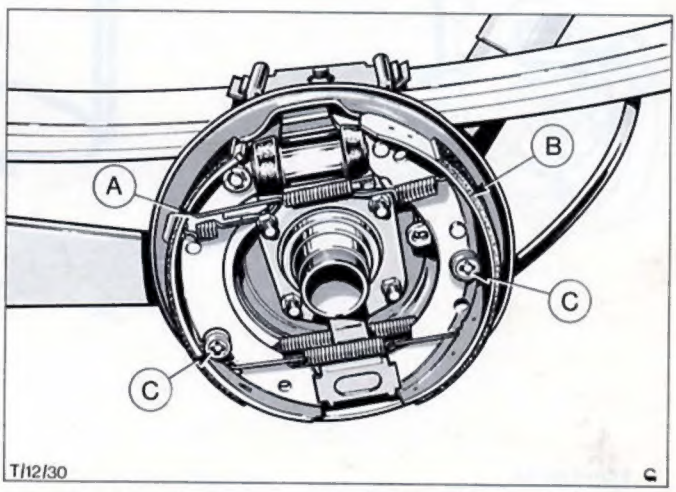

Fig.6. Rear brake assembly (LCX illustrated).
A - Leading shoe
B - Trailing shoe
C - Shoe hold-down springs

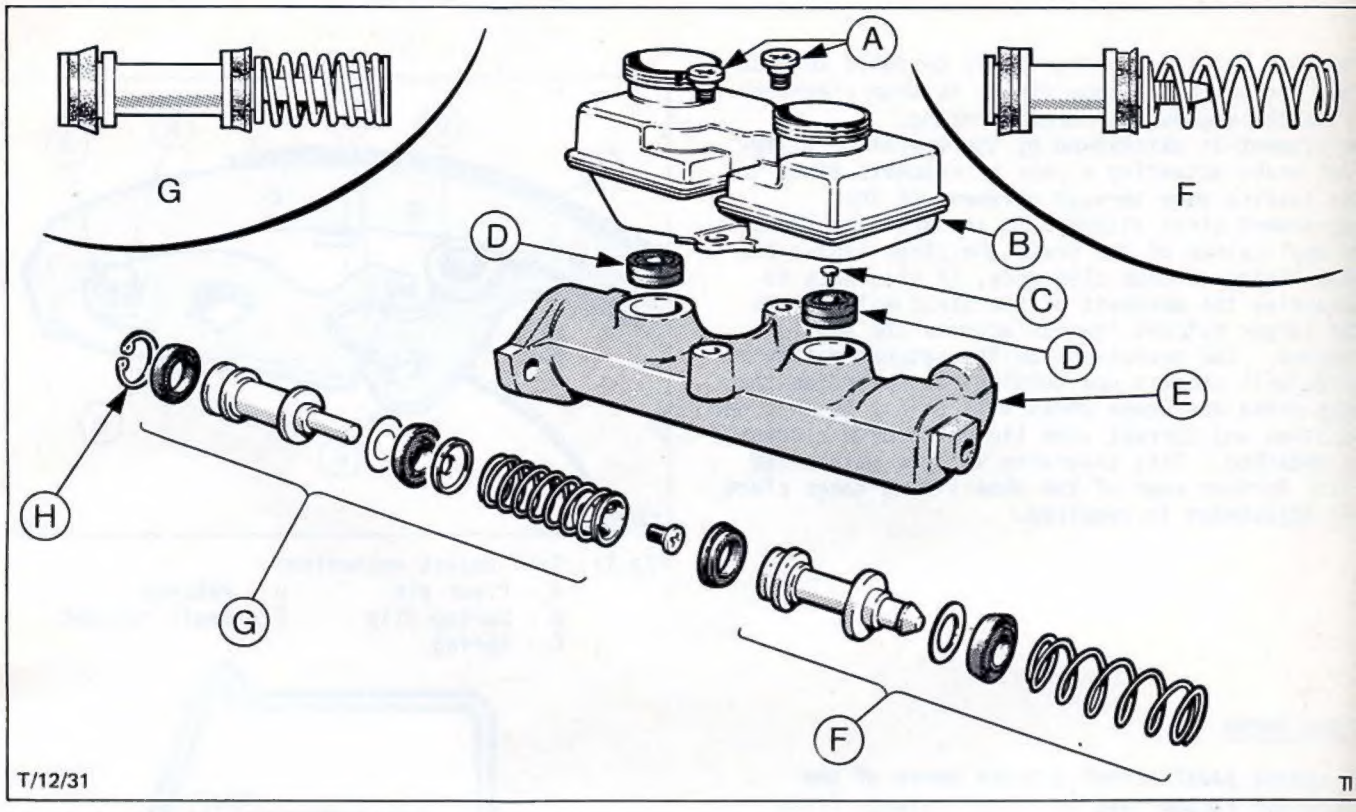

Fig.7. Master cylinder assembly.

A - Reservoir retaining screws
B - Semi-transparent reservoir
C - Secondary piston stop pin
D - Reservoir housing seals
E - Master cylinder body
F - Secondary piston assembly
G - Primary piston assembly
H - Piston retaining circlip

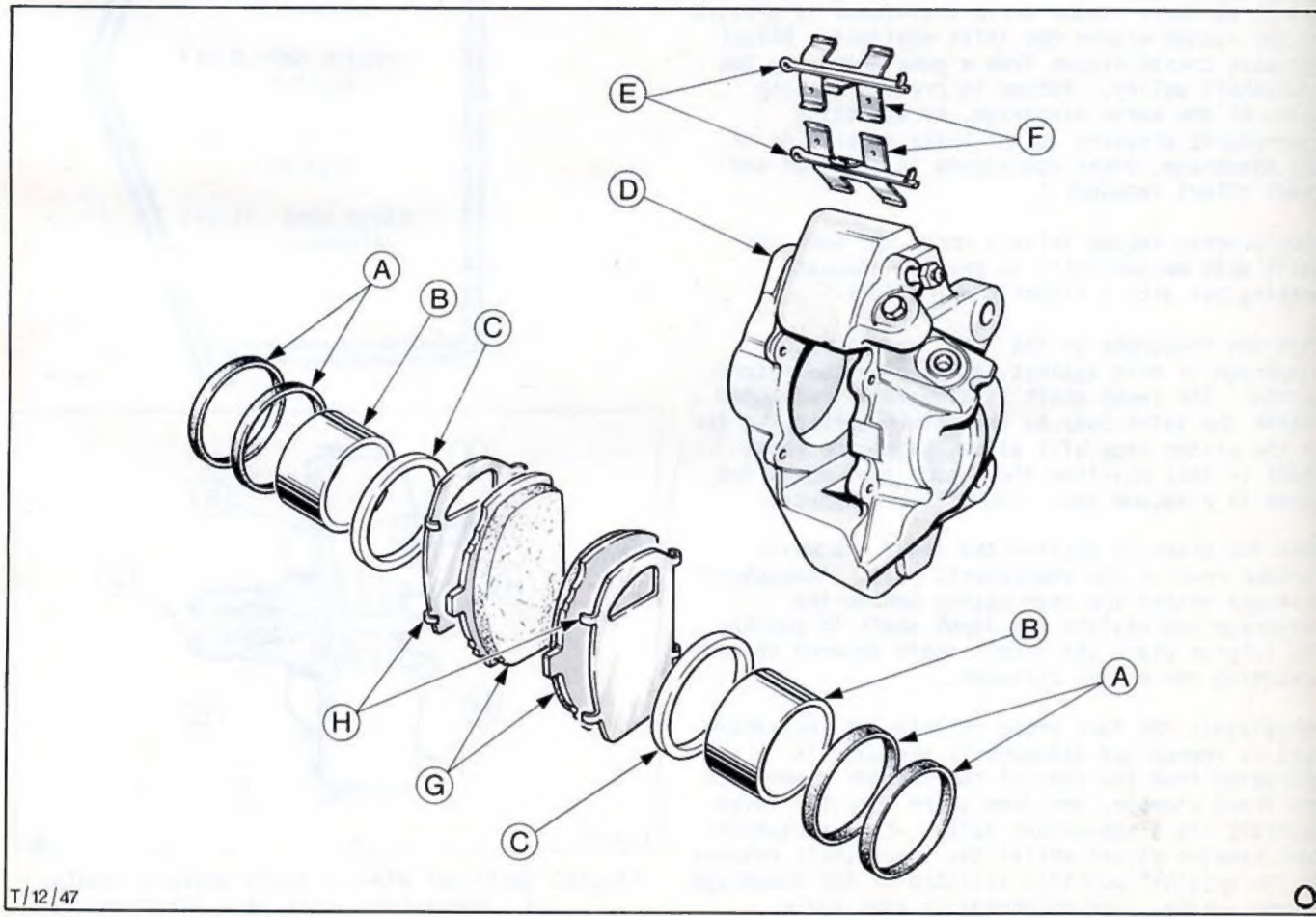

Fig.8. Two piston caliper.

A - Fluid seals
B - Piston
C - Seal retainers
D - Caliper housing
E - Pad retaining pins
F - Pad retaining clips
G - Brake pads
H - Shims

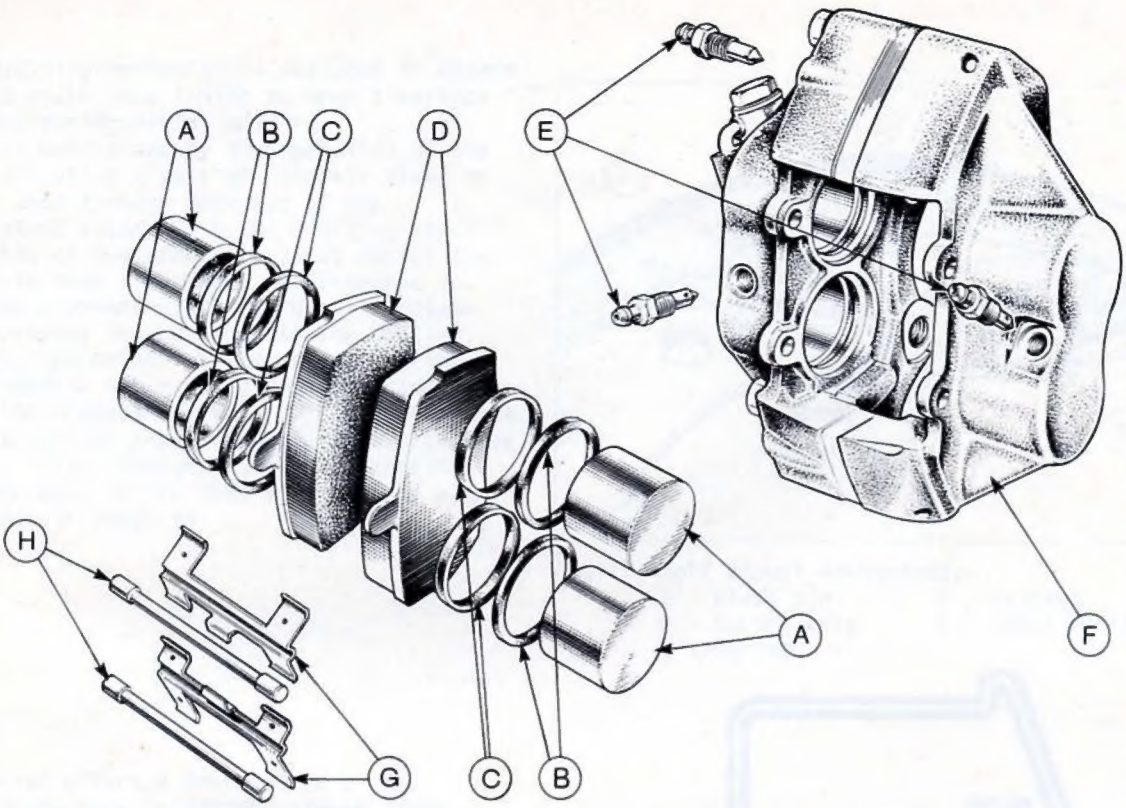

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Fig.9. Four piston caliper assembly.

A - Pistons
B - Fluid seals
C - Piston seal retainers
D - Brake pads
E - Bleed valves
F - Caliper housing
G - Anti-rattle clips
H - Pad retaining pins

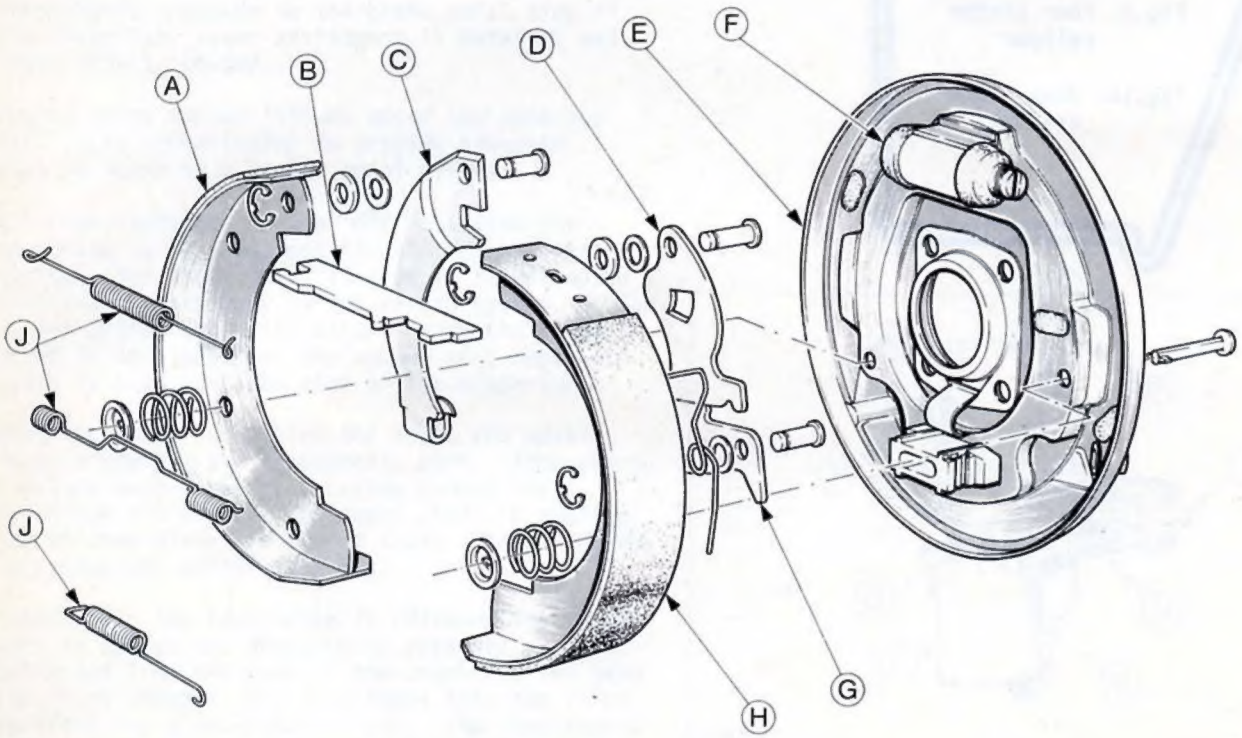

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Fig.10. Rear brake assembly.

A - Trailing shoe
B - Spacer strut
C - Handbrake lever
D - Ratchet
E - Carrier plate
F - Wheel cylinder
G - Adjustment ratchet
H - Leading shoe
J - Shoe return springs

The self adjusting mechanism is designed to ensure that correct brake shoe lining to drum clearance is maintained during normal braking. Adjustment is maintained by the operation of the foot brake actuating a pair of ratchets fixed to the leading shoe through movement of the adjustment strut attached to the trailing shoe. On application of the brake the strut senses the shoe lining to drum clearance, if clearance is excessive the movement of the strut will rotate the larger ratchet inwards accross the smaller ratchet. The serrations on the ratchet mating faces will adopt a new setting, on releasing the foot brake the brake shoes will adjust to this new position and correct shoe lining to drum clearance is obtained. This clearance will be maintained until further wear of the shoe lining takes place and adjustment is required.

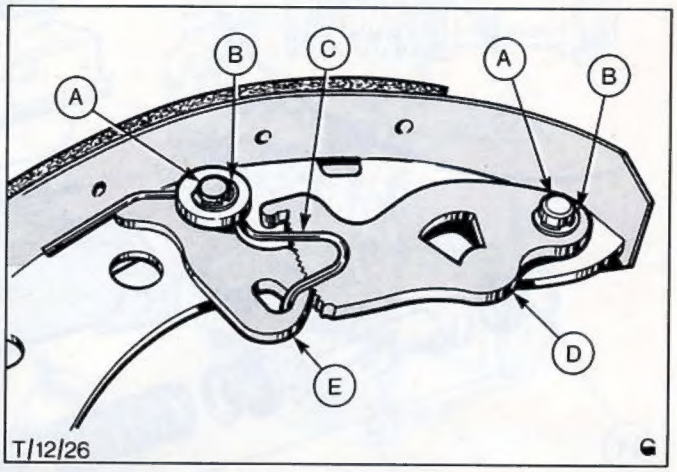


Fig.11. Self adjust mechanisms.
A - Pivot pin
B - Spring clip
C - Spring
D - Ratchet
E - Small ratchet

Brake Servo

To reduce pedal effort a brake servo of the suspended vacuum type is fitted between brake pedal and master cylinder.

The servo unit is designed to provide controlled power assistance during vehicle braking. For petrol variants vacuum servo assistance is created by the vacuum within the inlet manifold. Diesel variants create vacuum from a pump driven by the crankshaft pulley. Vacuum is created on both sides of the servo diaphragm, by admitting atmospheric pressure to the brake pedal side of the diaphragm, power assistance is obtained and pedal effort reduced.

Should servo vacuum failure occur the push rod still acts mechanically to provide adequate braking but with a higher pedal effort.

With the footbrake in the 'off' position the diaphragm is held against its stop by the return spring. The input shaft is also fully retracted within the valve body by the return spring, as far as the piston stop will allow. With the input shaft in this position the vacuum port opens and there is a vacuum each side of the diaphragm.

When the brake is applied the input rod moves forward opening the atmospheric port. Atmospheric pressure enters the rear casing behind the diaphragm and assists the input shaft in pushing the fulcrum plate and output shaft forward thereby actuating the master cylinder.

Immediately the foot brake is released the vacuum port is opened and atmospheric pressure is extracted from the rear of the chamber drawn into the front chamber, and from there into the inlet manifold via a non-return valve. The atmospheric port remains closed whilst the input shaft returns to its original position assisted by the diaphragm return spring. The diaphragm is then again suspended in vacuum until the brake pedal is depressed.

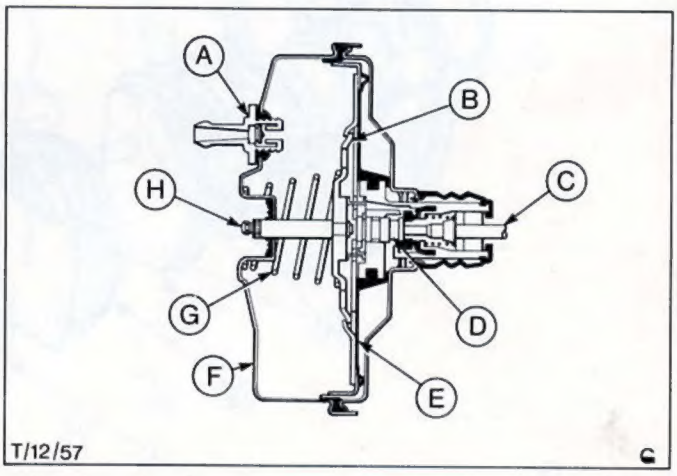


Fig.12. Sectional view of brake servo assembly.
A - Non-return valve
B - Fulcrum plate
C - Input shaft
D - Atmospheric port
E - Diaphram
F - Casing
G - Spring
H - Master cylinder push rod

Pressure Delay Valve

All disc braked variants are fitted with a pressure delay valve. The initial pressure required to actuate the rear drum brakes is higher than that for the front disc brakes. The purpose of the pressure delay valve is to restrict the pressure applied to the front brakes during brake operation until sufficient pressure is applied to the rear brakes.

The pressure delay valve is not serviceable and can only be replaced as a complete unit. The valve may be overridden to assist in brake bleeding if necessary, by depressing the 'button' on the valve throughout brake bleeding, Fig.13.

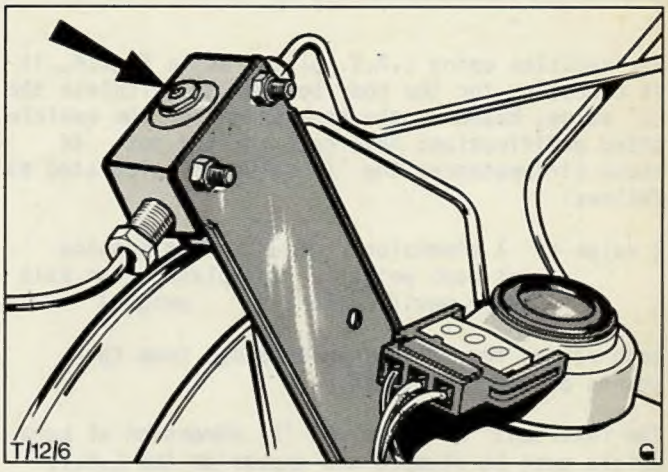


Fig.13. Pressure delay valve button.

Load Apportioning Valve (L.A.V.)

Dependent on territorial requirements a Load Apportioning Valve is fitted in production to the rear brake circuit. The function of the L.A.V. is to minimise the possibility of early 'lock-up' of the rear wheels under heavy or emergency braking, conditions with the vehicle in an unladen or partly laden condition.

The L.A.V. assembly is mounted on the vehicle chassis forward of the rear axle, and is connected to the rear axle via a lever and load sensing spring to the rear axle bracket.

Vehicles fitted with a L.A.V. (Austria and E.E.C. territories) also have an identification plate fitted to the left or right hand door step riser.

Variants produced for sale in Germany, Italy, Holland, Belgium, Denmark and Luxembourg have the plate depicting 'X' and 'Z' dimension, Fig.14. Variants built for United Kingdom and France have a L.A.V. check plate which is unique to that variant build, Fig.15.

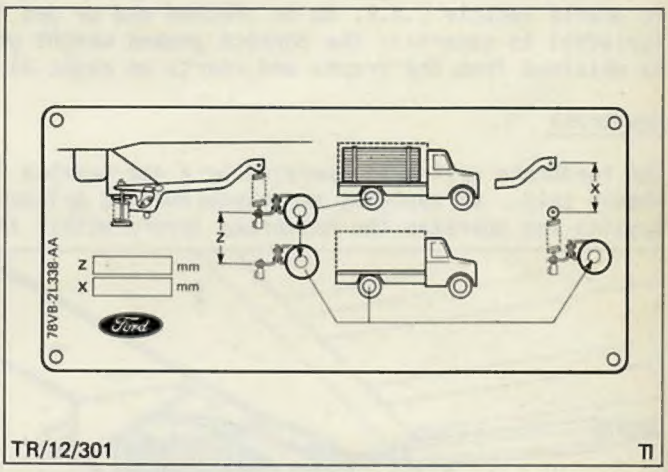


Fig.14. LAV identification plate unique to Germany Italy, Holland, Belgium, Denmark and Luxemburg.

All dimensions quoted on these plates are legal check dimensions and are calculated and stamped at plant or body builders, to comply with legal requirements. The 'X' dimension is the only adjustment possible to the Load Apportioning Valve. This setting determines the balance between front and rear brakes of the vehicle.

The 'Z' value indicates the useful travel of the Load Apportioning Valve. As this travel is a function of the vehicle design it cannot be adjusted and has no relevance to service adjustment or repairs. However, for territories specified above, it is a legal requirement for the 'Z' value to be stamped on the L.A.V. identification plate.

For standard factory produced bodies the 'X' and 'Z' value are stamped on the L.A.V. plate during manufacture.

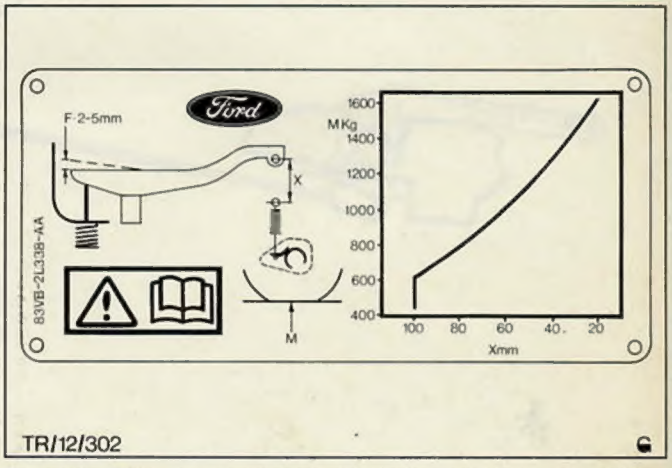


Fig.15. LAV plate unique to U.K. and France only.

Load Apportioning Valve (L.A.V.)

Vehicles with Specialist Bodies and Conversions

For vehicles using L.A.V. plates as in Fig.14. it is necessary for the body builder to calculate the 'Z' value, based on the kerb weight of the vehicle after modifications have been carried out. In these circumstances the 'Z' value is calculated as follows:

Z value = X dimension (at kerb weight after modification) minus X dimension (at plated rear axle weight)

Both values for 'X' can be obtained from the charts on pages 34 to 45.

The resultant 'Z' value and 'X' dimension at kerb weight must be stamped and appear on the L.A.V. identification plate.

The graphical type L.A.V. plate fitted to French and U.K. variants are for legal check applications only and no stamping is required. Fig.15.

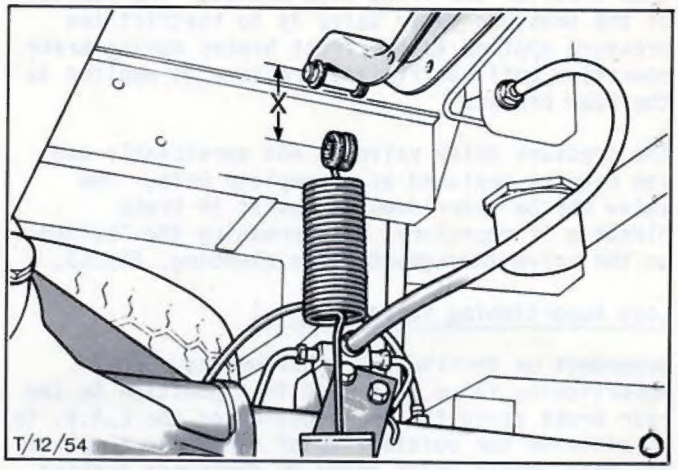


Fig.16. L.A.V. 'X' dimension.

To enable vehicle L.A.V. to be checked and or set it is essential that the vehicle is first weighed (unladen) to ascertain the correct ground weight of the rear axle. The 'X' dimension setting can then be obtained from the graphs and charts on pages 34 to 45.

Handbrake

The handbrake system is operated by a cab mounted lever between the front seats and acts on the rear wheels only. On applying the handbrake the primary rod is pulled forward, placing the handbrake under tension and operates the handbrake levers within the rear drum brakes.

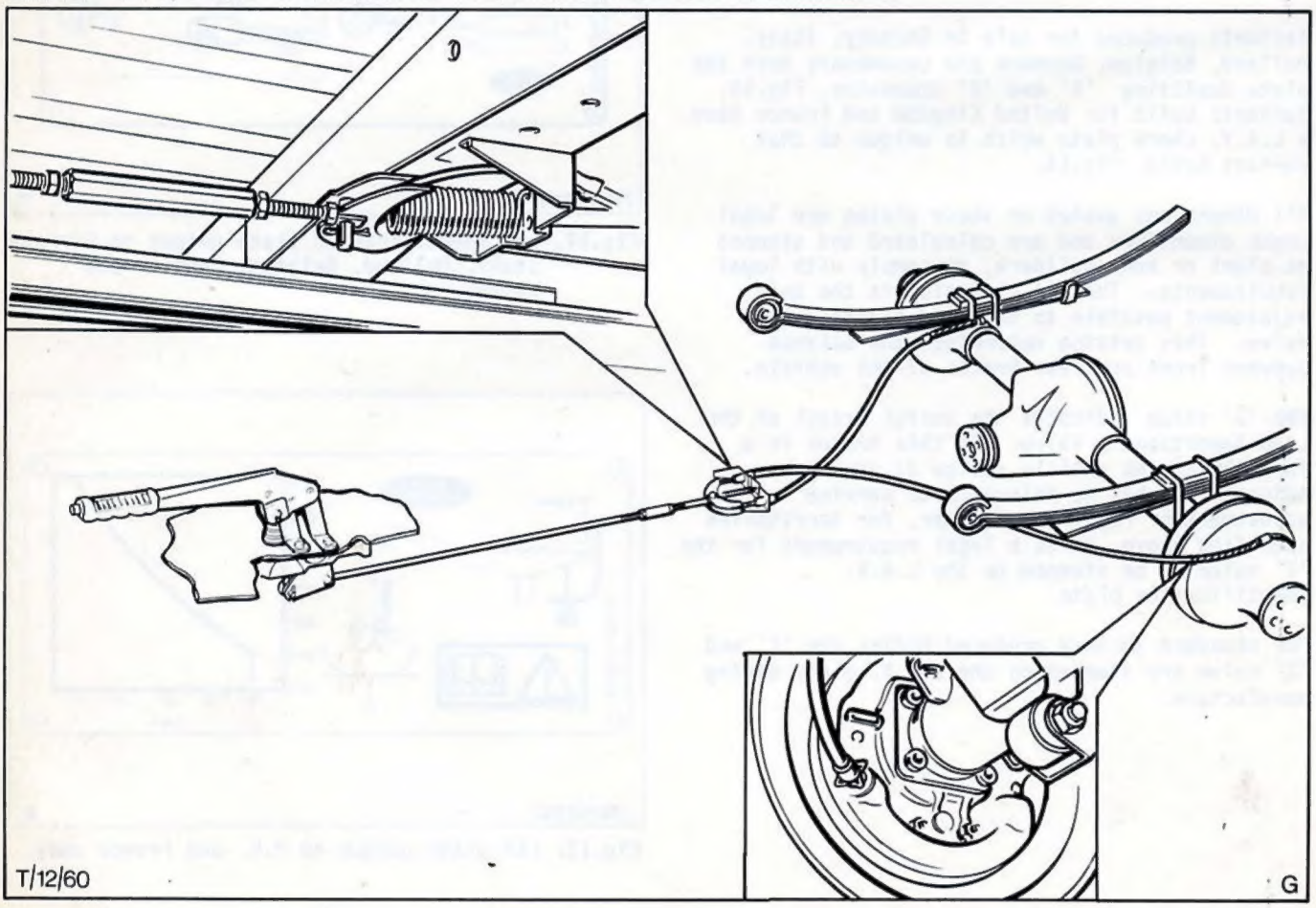
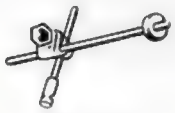


Fig.17. The handbrake system.

SPECIAL SERVICE TOOL RECOGNITION

TOOL	TOOL NAME
12-005	Wheel cylinder retaining clip replacer
15-011	Slide hammer
 15-022	Dial indicator holding fixture
15-029	Rear hub nut wrench
15-046	Metric dial indicator gauge
CP-3072-4B	Slide hammer adaptor*
GE-2031	Caliper piston expander*

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* This is a proprietary servicing tool available from suppliers such as V L Churchill & Company Limited, V Lowener and Optom SA and their agents.

SERVICE ADJUSTMENTS AND CHECKS

At the specified service intervals the following operations should be checked:

- Check and top up brake fluid reservoir
- Inspect brake hoses and hydraulic pipes for signs of leaks or chafing
- Check front brake pads and rear brake linings for wear
- Lubricate handbrake cable linkage

SERVICE AND REPAIR OPERATIONS

12 141 BRAKES - BLEED

SPECIAL SERVICE TOOLS REQUIRED: NONE

CAUTION: If brake fluid is spilt on paintwork, the affected area must be washed down with cold water immediately.

1. Remove reservoir cap and top up reservoir ensuring that both chambers of the reservoir are filled up to the 'MAX' mark with specified fluid.

2. Remove dust cap from R.H./L.H. caliper bleed nipple (caliper nearest master cylinder). Vehicles fitted with the four piston calipers have three bleed nipples, these must all be bled simultaneously.

3. Unscrew bleed nipples about half a turn, depress brake pedal and allow it to return to its stop. Continue to pump pedal until clear air free fluid is pumped into container.

NOTE: During this operation the master cylinder must be kept topped up to the 'MAX' mark.

4. Bleed remaining caliper and then rear brake circuit.

5. Top up reservoir to 'MAX' mark and replace cap and brake fluid/brake failure warning light connection.

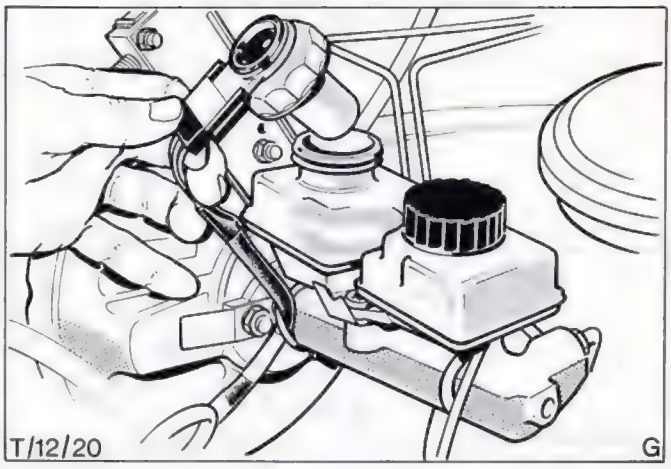


Fig.18. Master cylinder reservoir and fluid warning indicator.

12 154 4 BRAKE SYSTEM HYDRAULIC FLUID - REPLACE

SPECIAL SERVICE TOOLS REQUIRED:

Caliper piston expander .. .. GE 2031

NOTE: This procedure details how old brake fluid can be purged from the system by draining both front circuits of fluid and replenishing with new fluid. Rear brakes can be replenished in the normal method of bleeding both rears.

CAUTION: If brake fluid is spilt on paintwork, the affected area must be washed down with cold water immediately.

1. With vehicle jacked up or raised on ramp, connect bleed tube to both front calipers. Place other ends of tube in suitable containers to collect purged fluid, unscrew both front bleed nipples.

2. Remove master cylinder reservoir cap. Pump brake pedal fully and allow it to return quickly to rest. Continue to pump brake pedal until all fluid is purged and air is being pumped into containers (pause between strokes to allow brake master cylinder to recuperate).

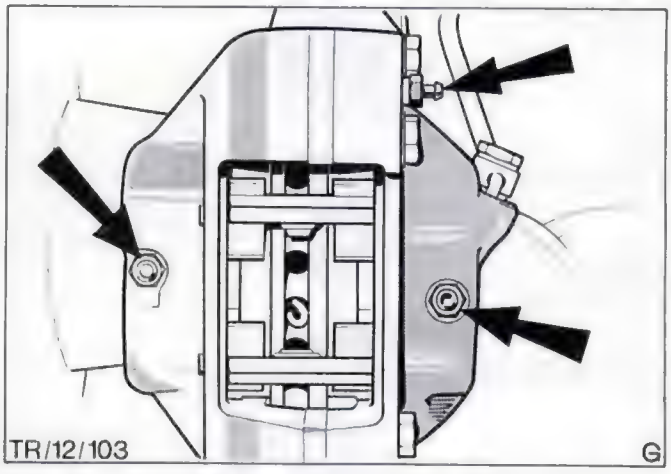


Fig.19. Four piston caliper bleed nipples.

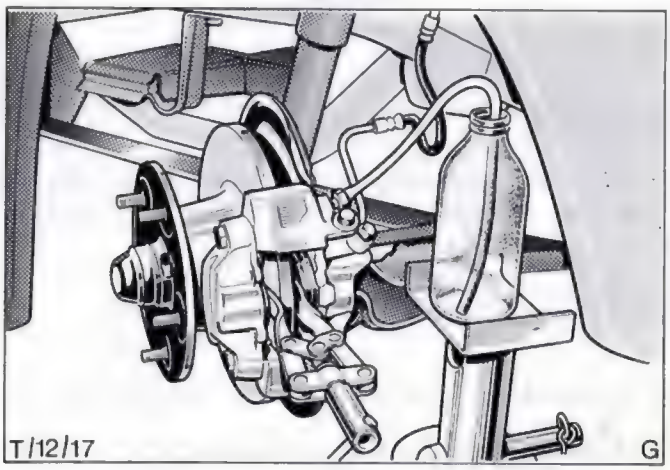


Fig.20. Caliper expander fitted to the two piston type caliper.

(Vehicles with four piston type caliper)

3. Insert suitable spacers between opposite pistons and disc face to allow each brake circuit to be purged individually.

4. Fit piston expander, and completely retract caliper piston. Continue depressing brake pedal until only air is being pumped out. Tighten bleed screw.

5. When first caliper has been purged, loosely refit pads to prevent pistons being forced out when second side is purged. After second caliper has been purged do not remove expander.

6. Position bleed tube from caliper to which caliper expander is still fitted, in a glass jar, containing a small quantity of approved brake fluid. Position jar at least 300 mm (12 in) above bleed nipple. This is to ensure that the bleed nipple itself is subjected to fluid pressure, thereby preventing possibility of air leaking past threads of bleed nipple and into braking sytem. Ensure end of bleed tube is kept immersed in brake fluid.

7. Unscrew bleed nipple.

8. Fill reservoir with new unused fluid meeting Ford Specification SAM-6-9103 A (amber). Continue depressing brake pedal pausing after each stroke until 'air free' fluid is seen passing through the bleed tube. With brake pedal held fully depressed retighten bleed screw and top up reservoir with new fluid as required.

9. Carefully unscrew piston expander to obtain maximum caliper piston travel. Depress brake pedal carefully, so moving caliper piston to its fully extended position. With pedal still depressed, unscrew bleed nipple. Using piston expander, force pistons back to their fully retracted position and then retighten bleed screw. Remove piston expander and refit brake pads.

10. Remove pads as fitted in sub-operation 5, and fit piston expander to other caliper so that pistons are in the fully retracted position. Repeat sub operations 6 to 9 for other front caliper circuit.

11. Bleed rear brake circuit until clean new fluid can be seen.

12. Check and top up brake fluid if necessary. Do not fill above 'MAX' mark on reservoir. Refit reservoir cap and electrical connections.

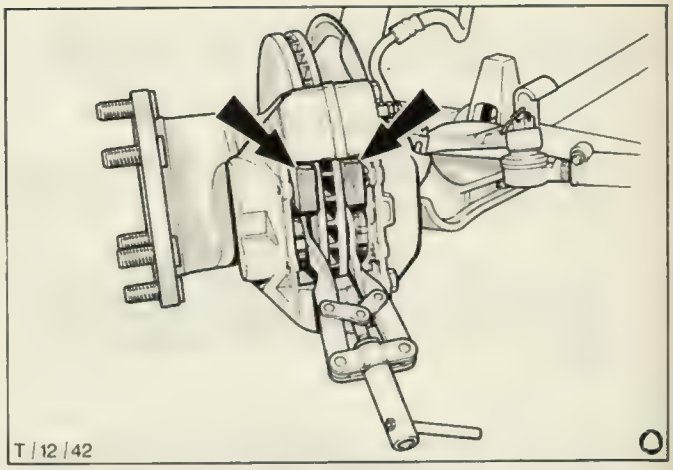


Fig.21. Fit suitable spacers between opposite pistons and disc face to enable each circuit to be purged individually. (four piston type caliper)

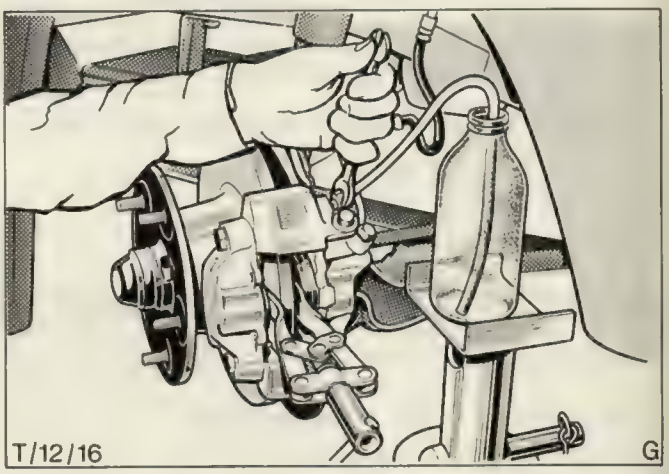


Fig.22. Position bleed jar 300 mm above bleed nipple.

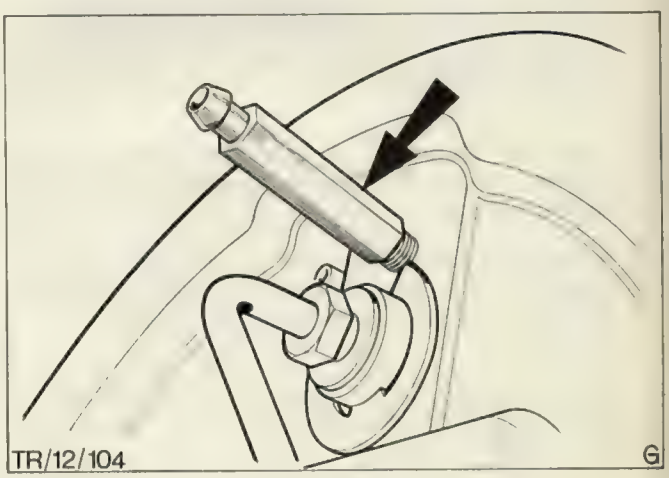


Fig.23. Rear brake bleed valve.

12 221 BRAKE DISCS - CHECK RUN OUT - BOTH SIDES

SPECIAL SERVICE TOOLS REQUIRED:

Dial indicator gauge	15-046
Dial gauge holding fixture	15-022

1. Remove wheels. Mount dial gauge fixture and gauge to steering arm. Adjust gauge plunger to measure run out at mid point of pad contact area.

NOTE: Check that wheel bearings are correctly adjusted. If necessary adjust bearings, refer to Operation 12 223.

2. Measure total run out, this should not exceed 0,13 mm (0,005 in). If this figure is exceeded the cause must be eliminated.
3. Reposition fixture and gauge, measure total run out of other face of disc.
4. Repeat sub-operations 1 to 3 for other disc.
5. Refit road wheels and torque wheel nut to correct specification.

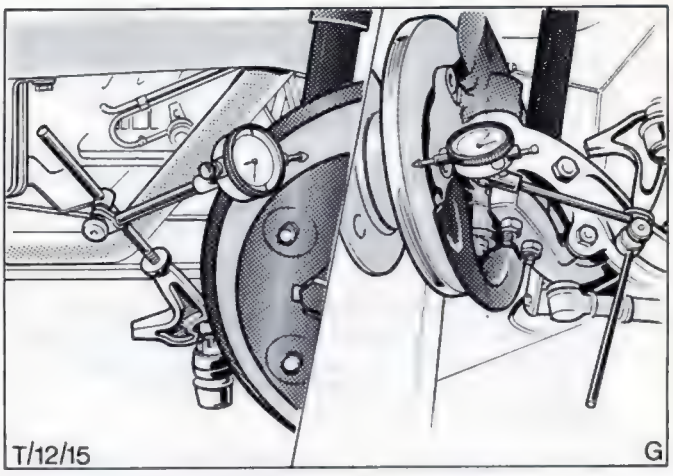


Fig.24. Check disc run-out.
A - Front of disc run-out check
B - Rear of disc run-out check

12 223 DISC FRONT BRAKE - REMOVE AND INSTALL (one side)

SPECIAL SERVICE TOOLS REQUIRED: NONE

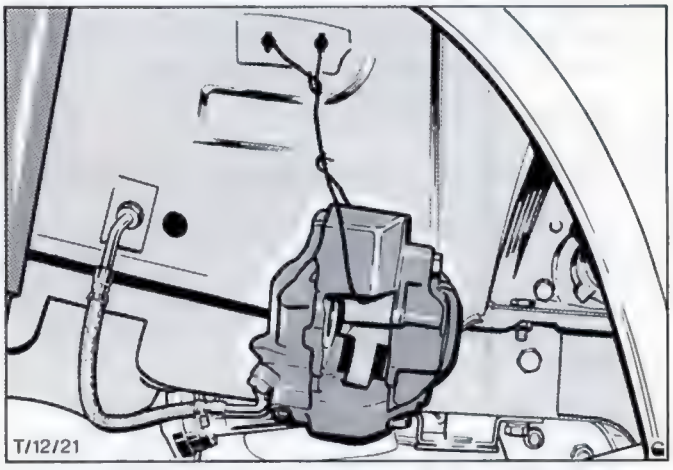


Fig.25. Suspend caliper to prevent undue strain on brake hoses.

To Remove

1. Remove road wheels.
2. Bend back lock tabs and remove two caliper securing bolts, and detach caliper assembly. Support caliper clear of hub assembly using a suitable length of wire.

NOTE: For vehicles with horizontally split braking systems remove flexible hose from caliper and remove caliper.

3. Remove hub grease cap, split pin, nut retainer, and adjusting nut. Detach front hub and disc assembly from spindle. Remove bearing.
4. Bend back lock tabs, remove disc/hub retaining bolts, separate hub from disc.

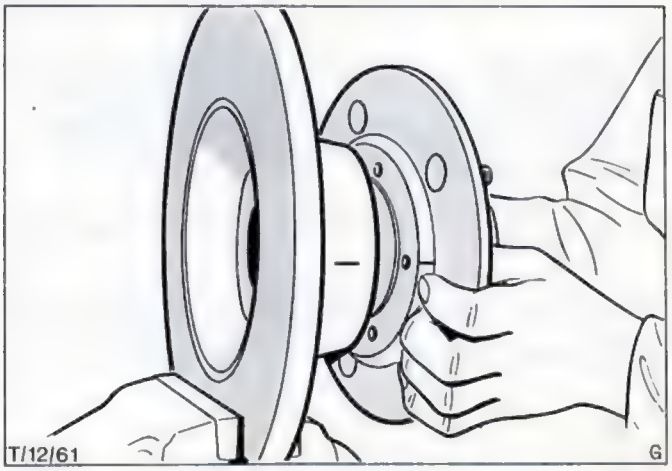


Fig.26. Front disc and hub aligning marks.

12 223

To Install

5. Ensure both contact faces on hub and disc are clean and free from any preservative, grease or burrs, Fig.26.

6. Refit disc to hub assembly, align mating face marks. Using new lock tabs, secure disc to hub and torque to specification, Fig.27.

7. Refit hub and disc assembly to spindle, fit taper roller bearing, washer and adjusting nut.

8. Check front disc run out, refer to Operation 12 221.

9. Reposition caliper assembly and secure. Torque bolts to specification (see Technical Data), secure lock tabs.

10. Refit road wheel and tighten wheel nuts.

11. Adjust wheel bearings.

    - Tighten adjusting nut to 20 to 25 Nm (2,0 to 2,5 Kgfm - 15 to 18 lbf.ft), while rotating the hub assembly in an anti-clockwise direction.
    - Slacken adjusting nut one half turn (180°), spin road wheel and retighten nut finger tight.
    - Ascertain that some free play exists, grasp top and bottom of wheel and impart a rocking motion, a small perceptible movement must be felt.
    - Fit nut retainer and new split pin, refit hub grease cap.

12. On vehicles with horizontally split braking system, refit brake hoses and bleed brakes, refer to Operation 12 141.

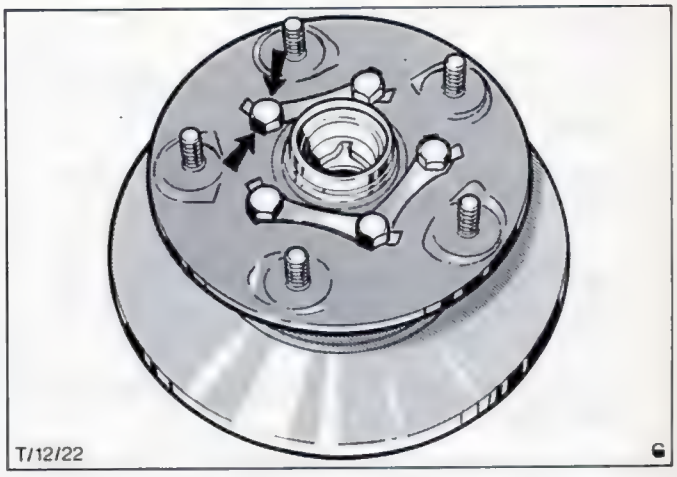


Fig.27. Hub to disc retaining bolts and locktabs.

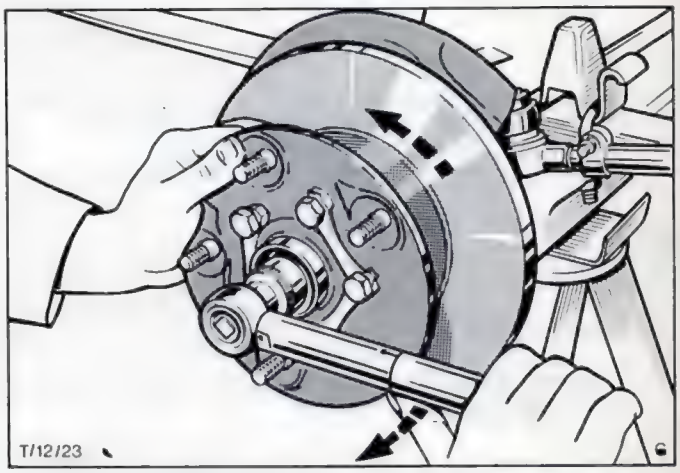


Fig.28. Torque hub adjusting nut to 20-25 Nm. (wheel removed for clarity)

12 233 DISC PADS - REPLACE (ONE SIDE)

SPECIAL SERVICE TOOLS REQUIRED: NONE

To Remove

1. Remove brake fluid reservoir cap and cover with clean cloth.

2. Remove front road wheels.

3. On four piston calipers, depress anti-rattle clips and remove two pad retaining pins and anti-rattle clips. On two piston calipers, straighten split retaining pin, depress clips and remove pin clips.

4. Remove disc pads, by pulling pads from caliper housing.

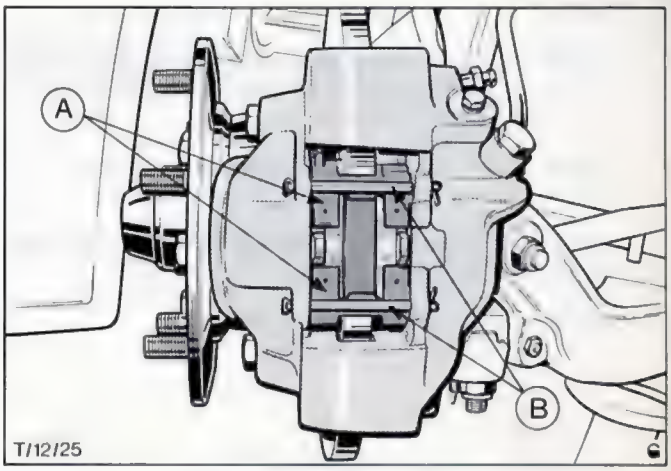


Fig.29. Disc pad retaining pins and clips.
A - Retaining clips
B - Retaining pins

12 233

To Install

5. Check pads are correct type. Also ensure that pads, retaining pins and disc are free from grease, oil or dirt.

6. Lever caliper pistons back into their bores with a flat iron bar.

NOTE: This action will cause fluid to return to the master cylinder which may overflow. To avoid this, examine fluid level and if necessary remove a quantity of fluid.

7. Fit pads and anti-rattle clips, depress clips and insert retaining pins.

8. Refit road wheels and tighten wheel nuts to specification.

9. Operate brake pedal several times to bring the pads into correct adjustment. Check and if necessary top up fluid reservoir. Replace reservoir cap.

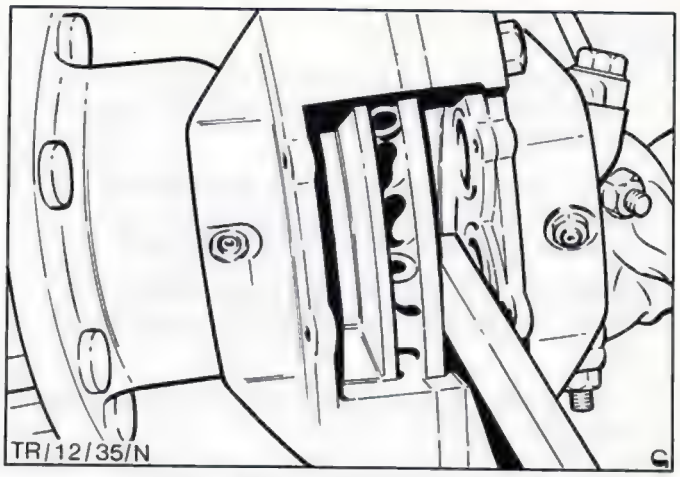


Fig.30. Lever caliper pistons back into bores using flat iron bar.

12 243 FRONT BRAKE CALIPER ASSEMBLY - REMOVE AND INSTALL (One Side)

SPECIAL SERVICE TOOLS REQUIRED: NONE

To Remove

1. Remove front wheel.

2. Disconnect caliper feed pipe(s), from caliper fit line plug(s).

3. Remove disc pads, refer to operation 12 333.

4. Prise back lock tabs, remove two caliper retaining bolts and detach caliper assembly from spindle carrier, Fig.31.

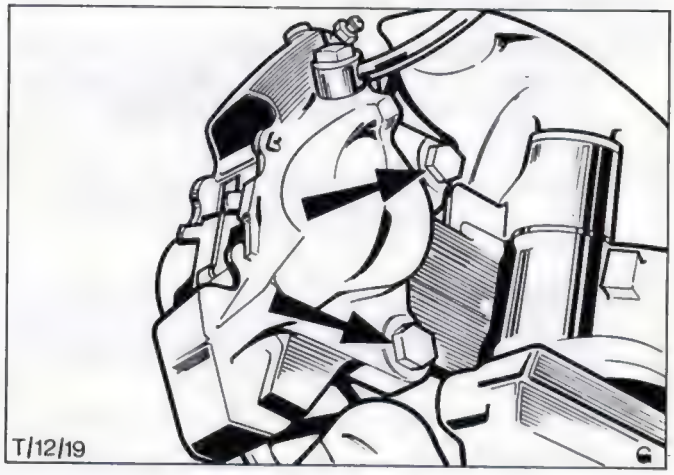


Fig.31. Caliper securing bolts to spindle carrier.

To Install

5. Locate and secure caliper on spindle carrier torque retaining bolts to specification, fit new lock tabs.

6. Remove line plugs and fit hydraulic hoses, Fig.32.

7. Refit disc pads, refer to operation 12 333 and bleed brake circuit.

8. Replace front wheels, tighten.

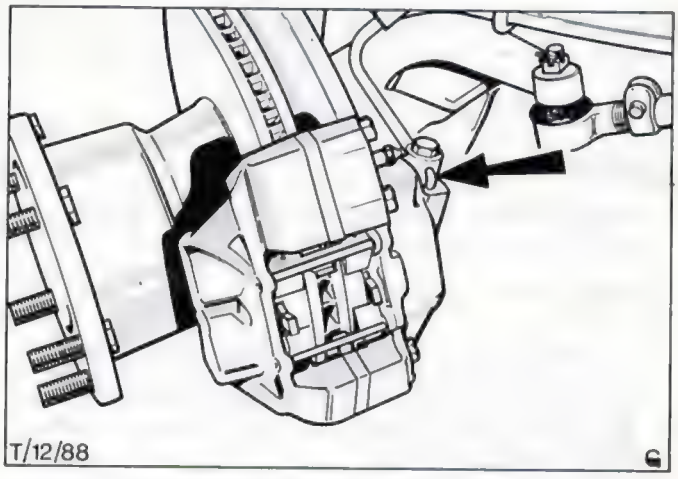


Fig.32. Reconnect hydraulic fluid pipes to caliper ensuring guide pin is located correctly in caliper.

12 285 SHOES - REAR BRAKE - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS REQUIRED:

Rear hub nut wrench 15-029

CAUTION: Brake dust when inhaled can be injurious to health.

To Remove

1. LCX variants only

   Slacken wheel nuts, remove wheels. Release handbrake, carefully remove brake drum.

   125 LCX and all LCY variants

   Remove axle shaft nuts, withdraw axle shaft. Bend up tags of nut retainer and unscrew bearing locknut using service tool 15 029. Remove adjusting nut and outer bearing cone. Remove hub, drum and wheel assembly.

2. Remove shoe hold down spring and cup, from leading shoe. Disconnect return spring from leading shoe, lift lower end of shoe up and away from carrier plate assembly and remove upper return spring, remove leading shoe.

3. Remove trailing shoe, hold down spring and cup. Pull shoe clear of wheel cylinder disconnect handbrake cable.

4. Dismantle leading shoe:

   - Remove spring clip from ratchet pawl, and withdraw pivot pin.
   - Remove spring clip from auto-adjust ratchet and remove pivot pin.

5. Dismantle trailing shoe:

   Remove spring and strut from handbrake lever and shoe, remove spring clip and pivot pin form trailing shoe.

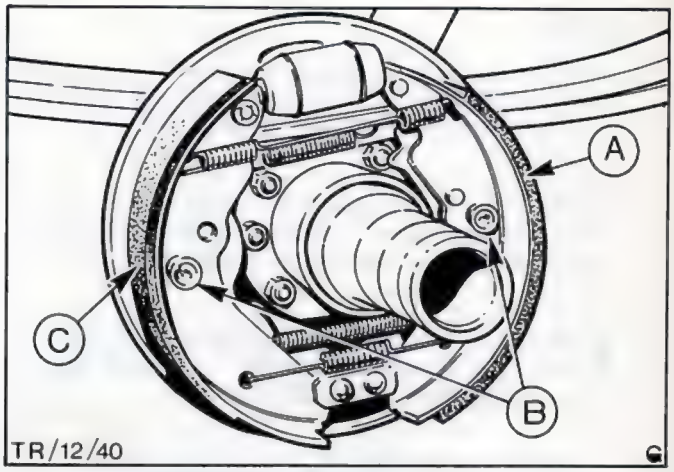


Fig.33. Rear brake shoe assembly. (LCY illustrated)
A - Leading shoe
B - Shoe hold down springs
C - Trailing shoe

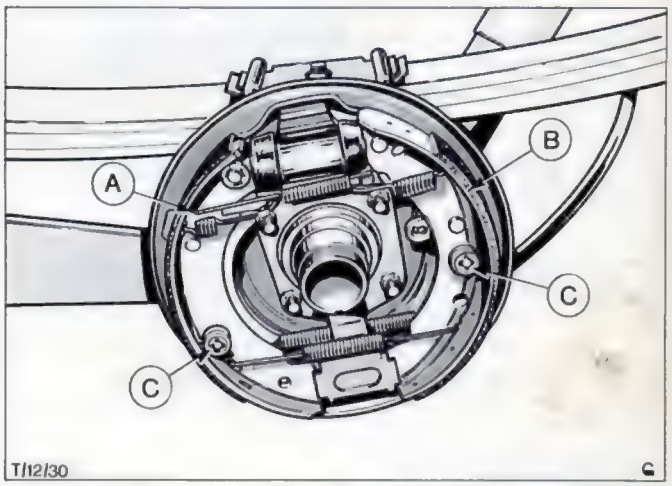


Fig.34. Rear brake shoe assembly. (LCX illustrated)
A - Leading shoe
B - Trailing shoe
C - Hold down clips

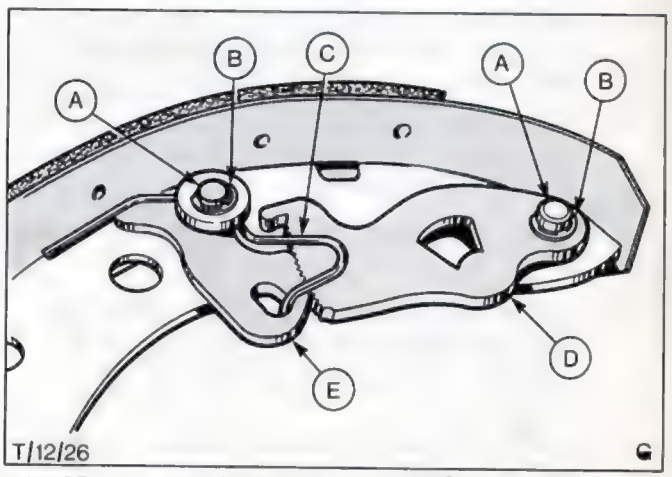


Fig.35. Leading brake shoe assembly.
A - Clevis pin
B - Circlip
C - Spring
D - Large ratchet
E - Small ratchet pawl

To Install

6. Before reassembling clean carrier plate, apply a light smear of Wolfrakote grease to the carrier plate brake shoe contact points.

7. Assemble trailing shoe with brake lever and strut, apply a small smear of grease between lever and brake shoe web, Fig.36.

8. Reconnect handbrake cable to lever, Fig.38. Secure shoe to carrier plate. Fit hold down pin, spring and retaining clip.

9. Assemble leading shoe and auto adjust ratchets, apply smear of lubrication between ratchets and shoe web, Fig.35.

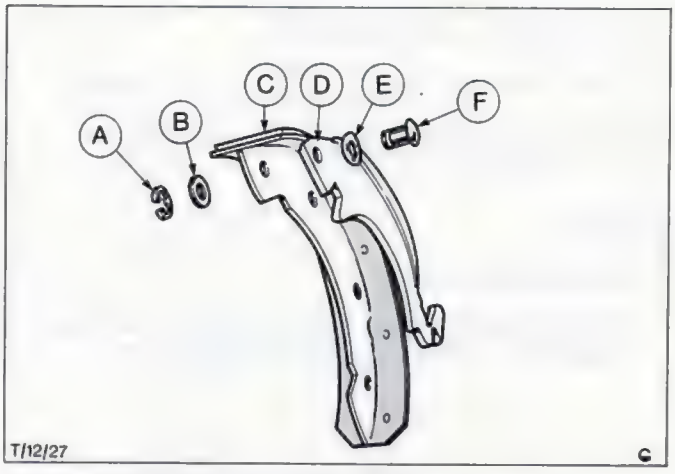


Fig.36. Assemble trailing shoe.
A - Circlip
B - Plain washer
C - Trailing shoe
D - Handbrake lever
E - Wave washer
F - Clevis pin

10. Locate leading shoe against lower pivot position and wheel cylinder, ensure spacer strut is located correctly.

11. Fit upper and lower brake shoe return springs.

12. Fit shoe hold down pin, spring and retaining clip.

13. Refit drum or hub/drum wheel assembly.

LCX variants only

- Refit brake drum, locating drum correctly against hub fit wheel and tighten wheel nuts.

125 LCX and all LCY variants

- Reposition hub and drum assembly onto axle. Fit outer roller bearing and adjusting nut.
- Torque adjuster nut to 67 to 88 Nm (6,7 to 8,8 kgf,m - 50 to 65 lbf.ft) whilst rotating hub assembly.
- Slacken adjusting nut one quarter of a turn (45°).
- Locate locking tab on to axle shaft, fit lock nut torque to 70 Nm (7,0 Kgf.m, 52 lbf,ft). Bend over lock tabs one on adjusting nut and another on lock nut.
- Refit axle shaft with new gasket, tighten retaining nut.

14. Apply foot brake several times to ensure correct auto adjustment.

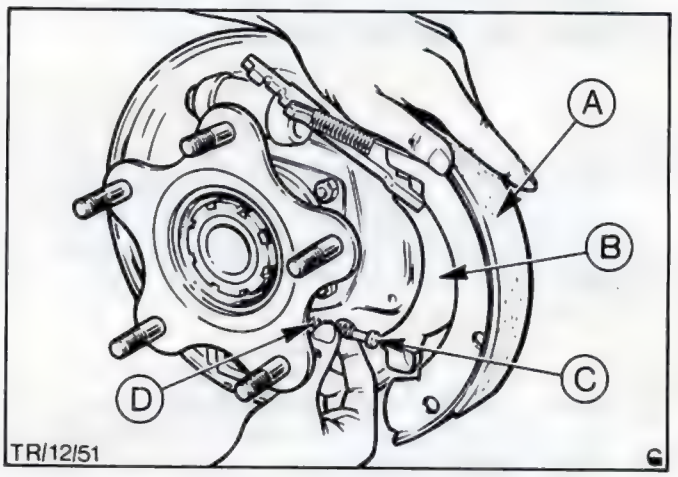


Fig.37. Reconnect handbrake cable to trailing shoe.
A - Trailing shoe
B - Handbrake lever
C - Handbrake cable
D - Cable spring

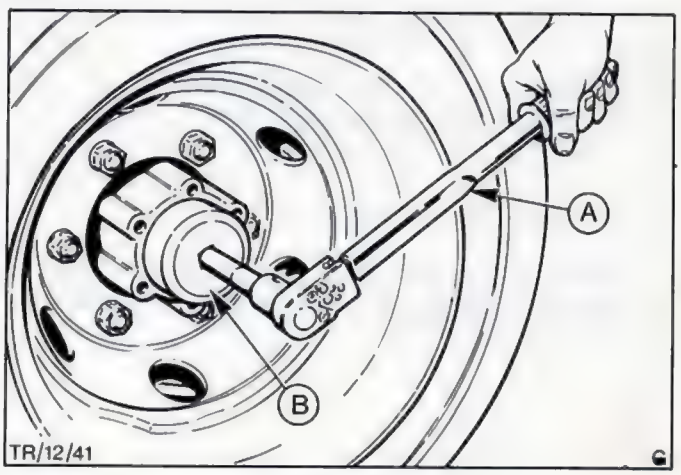


Fig.38. Torque rear hub bearing.
A - Torque wrench
B - Special service tool 15 029

12 305 WHEEL CYLINDER - BRAKE - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS REQUIRED:

Circlip installer 12-005

To Install

1. Remove brake shoe assembly, refer to Operation 12 285.
2. Disconnect hydraulic brake fluid pipe from wheel cylinder. Blank off to prevent excessive loss of fluid. Remove bleed nipple.
3. Prise cylinder retaining clip from its groove and remove wheel cylinder from brake carrier plate.

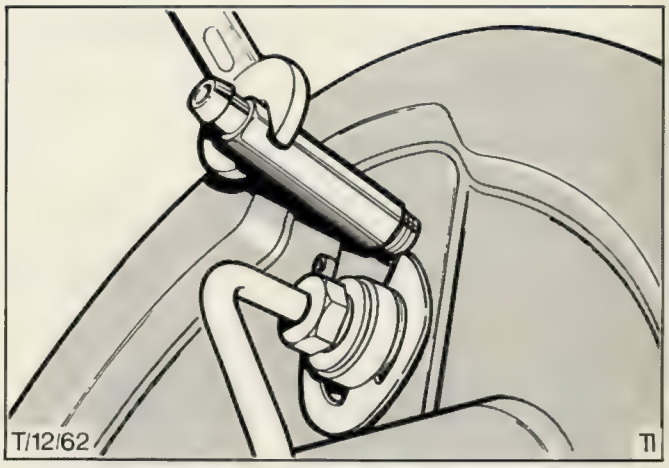


Fig.39. Disconnect hydraulic line and bleed valve.

To Install

4. Locate wheel cylinder on carrier plate ensure roll pin locates in hole on plate.
5. Assemble Special Service Tool 12 005 to cylinder and fit retaining clip.
6. Refit bleed nipple and hydraulic pipe. Tighten hydraulic pipe sufficient to seal.
7. Refit brake shoe assemblies refer to Operation 12 285.
8. Bleed brake system refer to Operation 12 141.

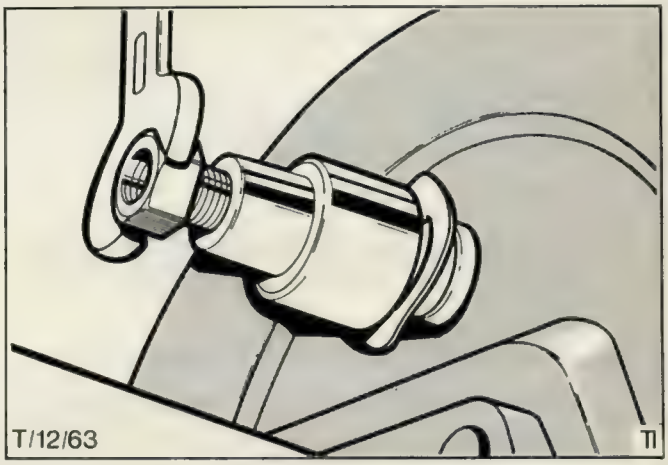


Fig.40. Special Service Tool 12-005 fitted to wheel cylinder.

12 305 8 WHEEL CYLINDER - REAR BRAKE - OVERHAUL (CYLINDER REMOVED)

SPECIAL SERVICE TOOLS REQUIRED: NONE

To Dismantle

1. Remove rubber dust covers, pull out pistons one from each end and remove spring from cylinder bore.
2. Using suitable tool remove piston seals.

   Before reassembly check cylinder bores for rust or scores, if either are present a new cylinder must be fitted.

To Reassemble

3. Ensure wheel cylinder bore and pistons are wiped clean of any foreign matter with a clean non-fluffy cloth using clean brake fluid or methylated spirits.
4. Fit new seals to wheel cylinder pistons.
5. Slide one of the pistons into cylinder bore. From the other end insert spring and second piston. Fit new rubber dust covers.

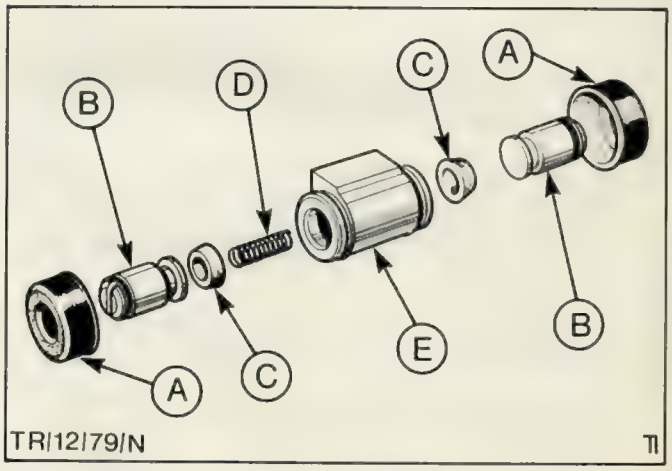


Fig.41. Wheel cylinder assembly.
A - Dust cover
B - Piston
C - Seal
D - Spring
E - Cylinder

12 313 PLATE - REAR BRAKE CARRIER - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS REQUIRED:

Wheel cylinder retaining clip replacer	12-005
Rear hub nut wrench	15-029

To Remove

1. Remove rear brake shoes as described in Operation 12 285.
2. Remove wheel cylinder, refer to operation 12 305.
3. Remove handbrake cable securing clip from carrier plate, remove handbrake cable.
4. Remove nuts securing carrier plate and oil baffle to axle housing.

   o On LCX variants it is necessary to remove hub assembly to gain access to carrier plate securing nuts as detailed below:

   a. Remove axle shaft.

   b. Bend up lock tab and remove retaining nut using Special Service Tool 15 029, remove outer bearing.

   c. Remove hub assembly using suitable puller.

   d. Remove carrier plate as described in sub-operation 4.

To Install

5. Before reassembly ensure carrier plate and oil baffle mating faces are free and clean of old sealant.
6. Install carrier plate onto axle, coat mating face of oil baffle with suitable sealer and secure to axle housing.
7. On LCX variants refit hub assembly, fit outer bearing, locktab and retaining nut, tighten to a torque of 176 to 189 Nm (18 to 19,5 kgf.m) (130 to 140 lbf.ft). Bend over lock tab and fit halfshaft.
8. Refit handbrake cable to carrier plate and secure with clip at rear of plate.
9. Install wheel cylinder, refer to Operation 12 305.
10. Assemble and install rear brake shoes, refer to Operation 12 285.
11. Bleed brake circuit, refer to Operation 12 141.

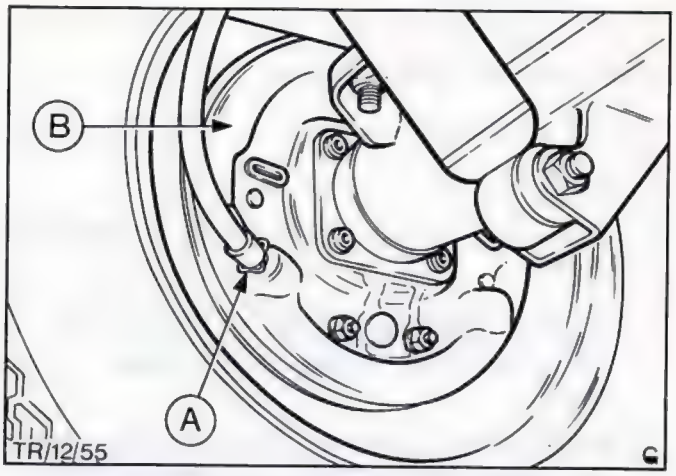


Fig.42. Remove handbrake cable to carrier plate retaining clip.
A - Retaining clip
B - Brake carrier plate

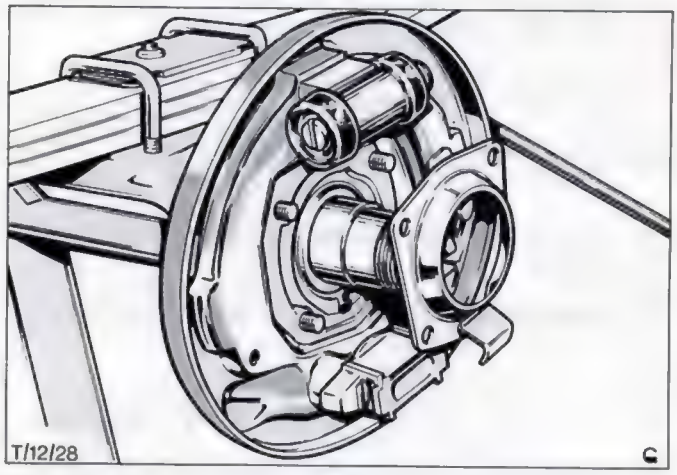


Fig.43. Locate carrier plate and oil baffle on axle housing.

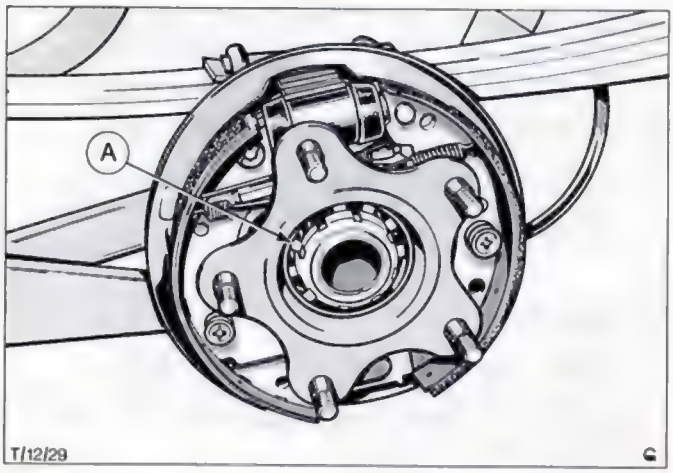


Fig.44. Assemble rear hub retaining nut and lock tab.
A - Bend over lock tab to secure retaining nut

12 333 BRAKE PEDAL - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS REQUIRED: NONE

To Remove

1. Remove spring clip and clevis pin connecting brake pedal to servo operating rod.
2. Remove heater assembly, refer to Operation 34 354.
3. Disconnect pedal, return spring and circlip from left hand end of pedal shaft.
4. Withdraw brake pedal cross shaft and remove brake pedal.
5. Remove pedal bushes and pedal pad.

To Install

6. Install bushes and refit pedal pad if removed, Fig.47.
7. Install pedal cross shaft to brake and clutch pedal, ensure cut out in pedal box locates with flat on shaft, push fully home and secure with circlip.
8. Refit brake pedal return spring.
9. Install heater, refer to Operation 34 354.
10. Align servo connecting rod with brake pedal fit clevis pin and spring clip.

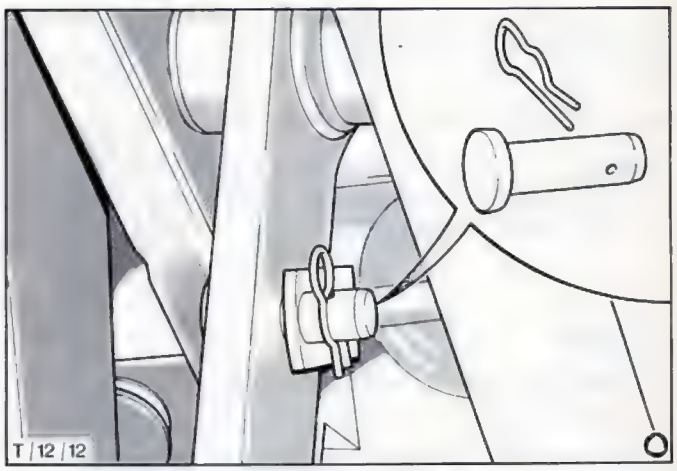


Fig.45. Disconnect brake pedal to servo operating rod. Clevis and spring clip.

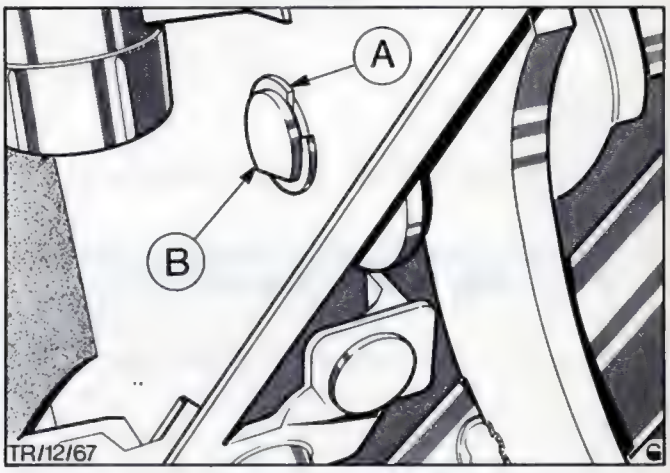


Fig.46. Pedal cross shaft securing circlip.
A - Circlip
B - Pedal shaft

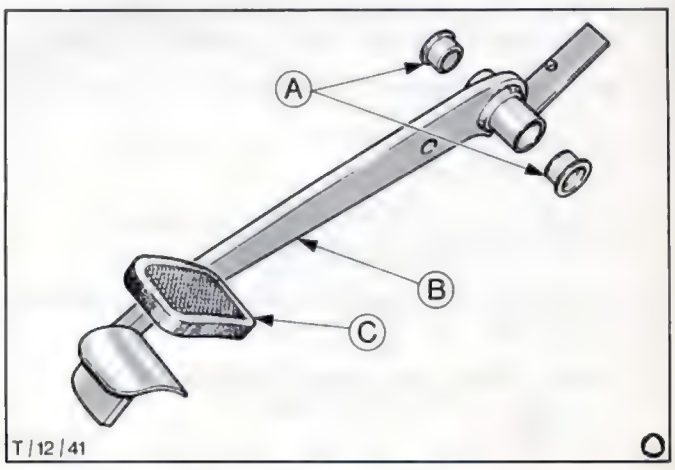


Fig.47. Pedal bushes and pedal pad.
A - Pedal bushes
B - Brake pedal
C - Pedal pad

12 343 MASTER CYLINDER - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS REQUIRED: NONE

CAUTION: If brake fluid is spilt on paintwork the affected area must be washed down with cold water immediately.

To Remove

1. Disconnect brake fluid warning indicator loom.
2. Disconnect hydraulic fluid brake pipes, fit blanking plugs to prevent excessive fluid loss or dirt entry.
3. Remove nuts securing master cylinder to servo housing, carefully remove cylinder from vehicle.

To Install

4. Refit master cylinder to servo mounting and secure.
5. Reconnect hydraulic fluid brake pipes and bleed brakes, refer to Operation 12 141.
6. Reconnect brake fluid warning indicator loom.

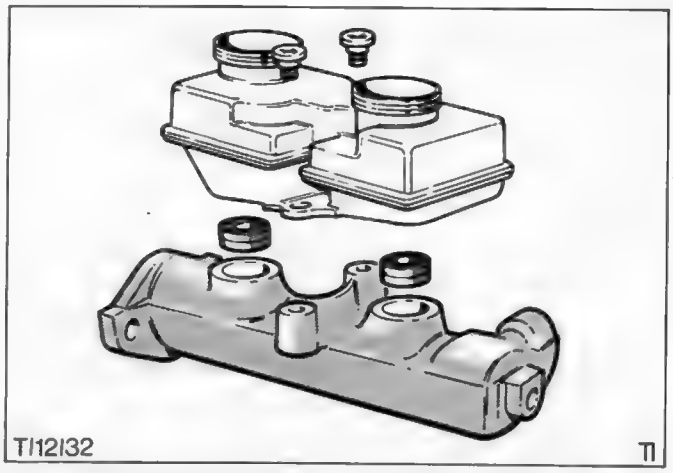


Fig.48. Remove reservoir and cylinder to reservoir fluid seals.

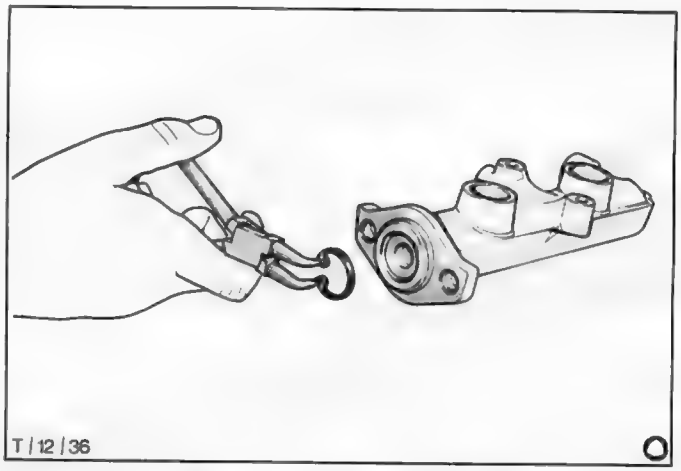


Fig.49. Remove master cylinder piston retaining circlip.

12 343 8 MASTER CYLINDER OVERHAUL - (CYLINDER REMOVED)

To Dismantle

1. Drain brake fluid from reservoir. Remove screws securing reservoir to master cylinder.
2. Prise out reservoir to cylinder fluid seals.
3. Depress piston assemblies and remove secondary stop pin, Fig.50.
4. Remove piston retaining circlip, remove primary and secondary piston.
5. Remove primary piston spring sleeve and screw, remove seals and shim from piston.
6. Remove spring and sleeve from secondary piston, hook off fluid seals.

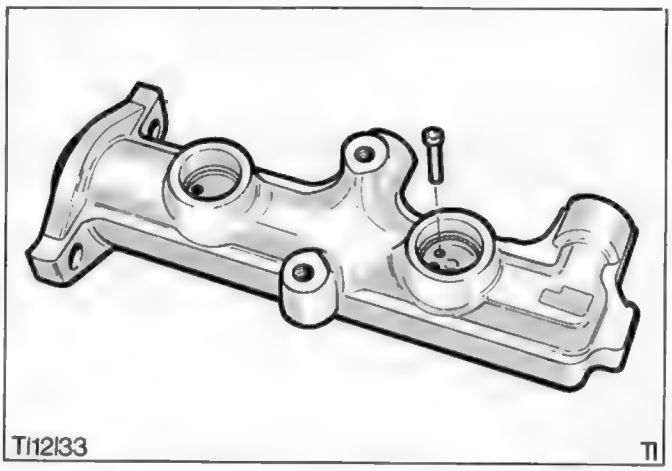


Fig.50. Remove secondary piston stop pin.

12 343 8

To Assemble

Before assembly check cylinder bore and pistons for damage, renew if necessary.

7. Assemble primary and secondary pistons with new seals dip pistons into clean brake fluid and assemble into master cylinder.

8. Fit piston retaining circlip. Depress piston assemblies fully and insert secondary piston stop pin into its cylinder location hole.

9. Insert reservoir seals and refit fluid reservoir, secure with two screws.

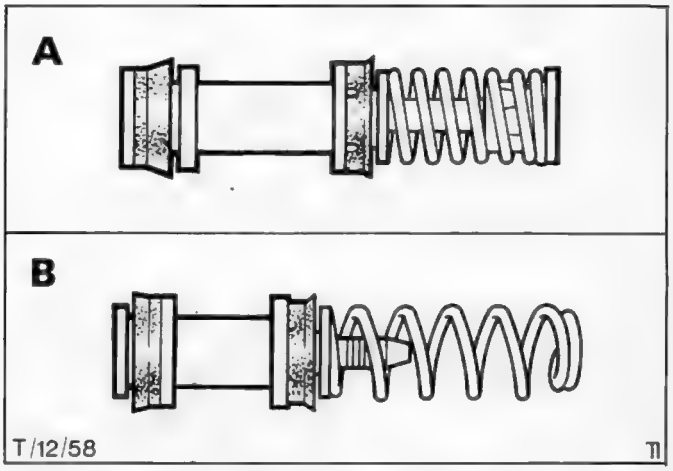


Fig.51. Master cylinder piston assemblies.
A - Primary piston
B - Secondary piston

12 414 VACUUM PUMP - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS REQUIRED: NONE

To Remove

1. Open hood fit fender covers, disconnect battery.

2. Drain cooling system and disconnect radiator hoses.

3. Remove upper radiator mounting bolts and insulators.

4. Remove front grille securing bolts, remove grill leaving radiator still in position.

5. Remove radiator lower mounting bolts, lift out radiator.

6. Slacken vacuum pump drive belt jockey wheel securing nut and bolt, remove drive belt.

7. Slacken pump drive pulley centre nut. Remove three bolts securing drive pulley to pump drive hub, remove pulley.

8. Using suitable puller remove pump drive hub, and remove woodruff key from tapered shaft.

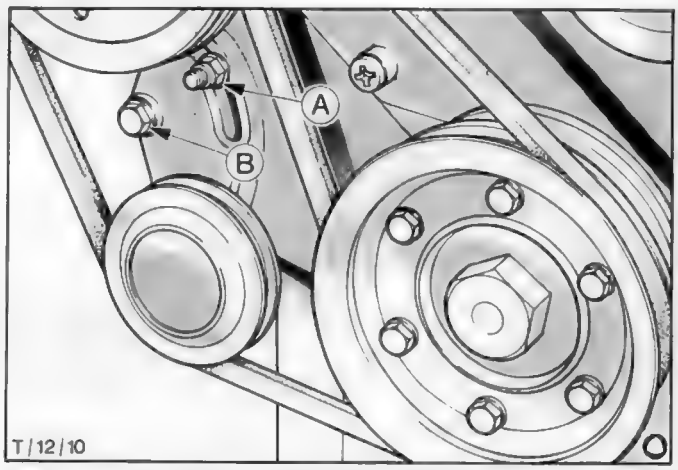


Fig.52. Slacken pump jockey pulley.
A - Adjusting locknut
B - Pivot bolt

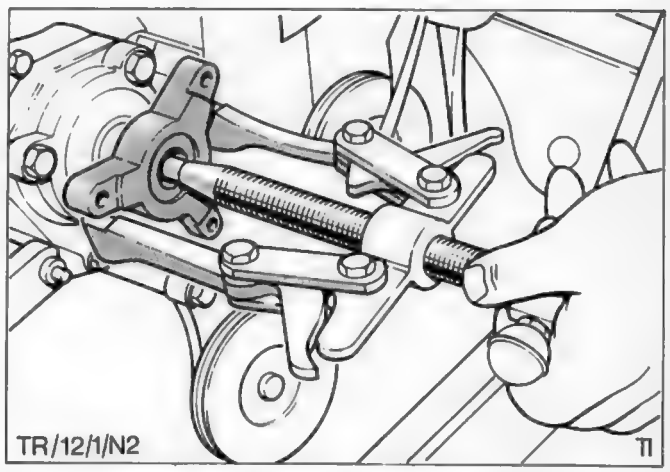


Fig.53. Remove pulley and hub assembly using suitable puller.

9. Remove seal housing and seal assembly, Fig.55.

10. Disconnect vacuum servo supply hose and adaptor.

11. Remove rear pump support bracket retaining bolts, Fig.54.

12. Remove three bolts securing vacuum pump cover to front engine mounting plate. Remove two bolts and one nut securing pump, remove pump from engine.

13. Remove seal from intermediate vacuum pump mounting plate.

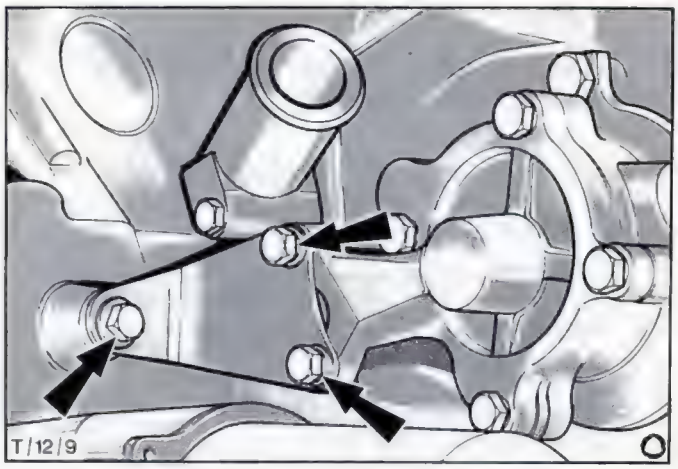


Fig.54. Vacuum pump support bracket.

To Install

14. Fit new seal to intermediate mounting plate. Fit and secure vacuum pump together with new crimped gasket.

15. Refit vacuum pump rear support bracket.

16. Replace seal in housing, refit housing over pump driveshaft, fit woodruff key to shaft. Locate hub on shaft and secure, refit pulley.

17. Reconnect vacuum hose connections to pump.

18. Refit drive belt, adjust belt tension to give a total free movement of 12 mm (0,5 in) on the longest span of belt, Fig.56.

19. Refit radiator on lower mountings, and secure reconnect radiator hoses.

20. Refit front grille, reconnect hood release cable, and secure upper radiator mountings.

21. Reconnect battery and remove fender covers.

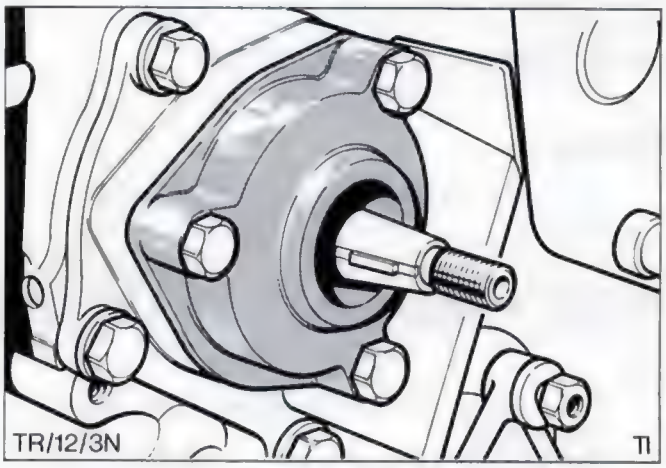


Fig.55. Remove seal and seal housing.

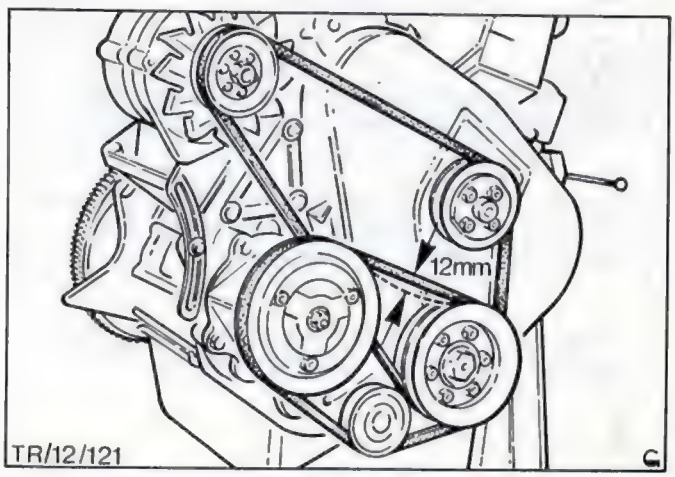


Fig.56. Check drive belt free play.

12 451 SERVO - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS REQUIRED: NONE

To Remove

1. Disconnect fluid hydraulic pipes from master cylinder and pressure delay valve. Fit blanking plugs to master cylinder and pipes to prevent dirt ingress and fluid loss.
2. Carefully remove vacuum check valve from servo housing, (remove buzzer switch if fitted).
3. Detach servo operating rod from brake pedal.
4. Remove three nuts and washers securing servo bracket to bulkhead, remove servo and brake master cylinder from vehicle.
5. Remove gaiter and servo bracket from servo unit.
6. Remove master cylinder and pressure delay valve assemblies from servo unit.

To Install

7. Fit master cylinder and pressure delay valve assemblies to servo.
8. Refit servo mounting bracket and gaiter to servo tighten servo bracket retaining nuts.
9. Locate servo unit onto studs in bulkhead and secure.
10. Install check valve to servo housing (reconnect buzzer switch if fitted).
11. Reconnect fluid lines to master cylinder and pressure delay valve.
12. Fit clevis pin and spring clip to brake pedal servo operating rod.
13. Bleed brakes as described in Operation 12 141.

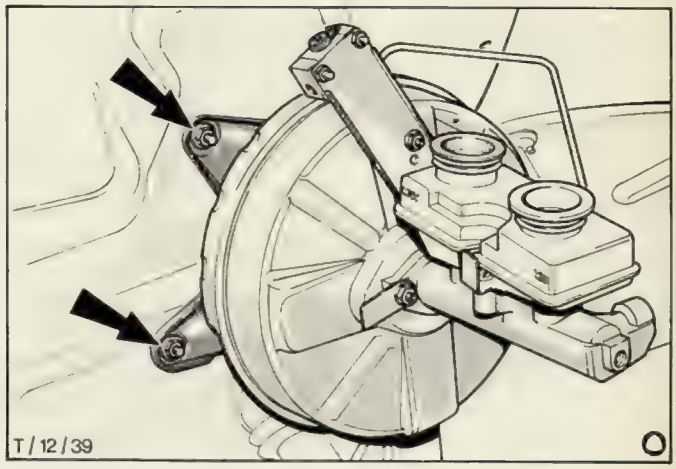


Fig.57. Servo mounting bracket to bulkhead retaining nuts.

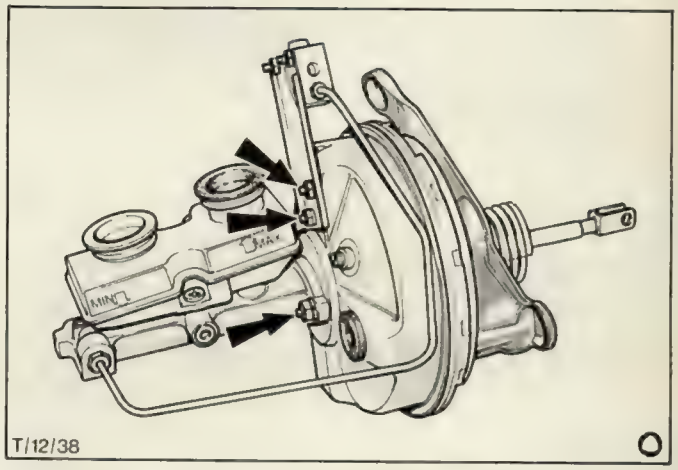


Fig.58. Remove master cylinder and pressure delay valve.

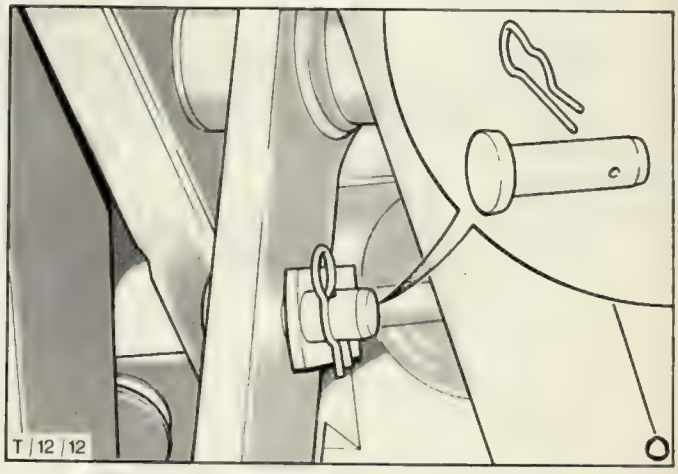


Fig.59. Servo operating rod to brake pedal.

12 457 CHECK VALVE - SERVO - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS REQUIRED: NONE

To Remove

1. Disconnect hose from check valve.

NOTE: If a crimped type hose clamp is fitted, it should be cut free and replaced with a screw type hose clamp.

2. Carefully lever check valve from servo unit.

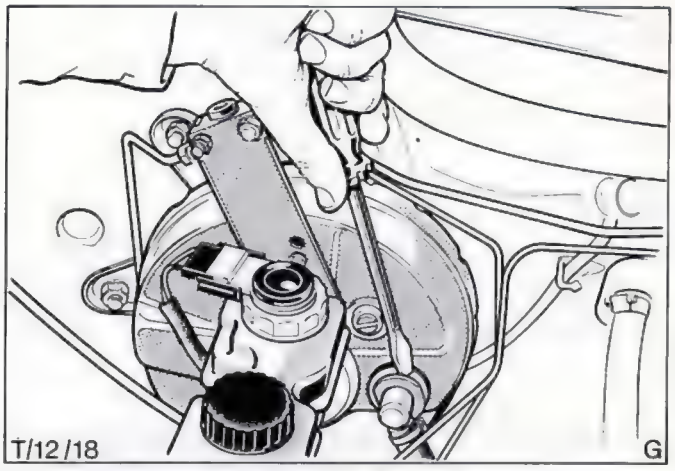


Fig.60. Servo vacuum check valve

To Install

3. Press valve into servo unit ensuring outlet is in the same position as before removal.

4. Connect hose to check valve and secure screw clamp.

12 481 VACUUM HOSE - SERVO - REPLACE

SPECIAL SERVICE TOOLS REQUIRED: NONE

To Remove

1. Disconnect hose from inlet manifold and servo check valve.

NOTE: If a crimped type hose clamp is fitted it should be cut free and replaced with a screw type hose clamp.

To Install

2. Reconnect hose to inlet manifold connection. Fig.61.

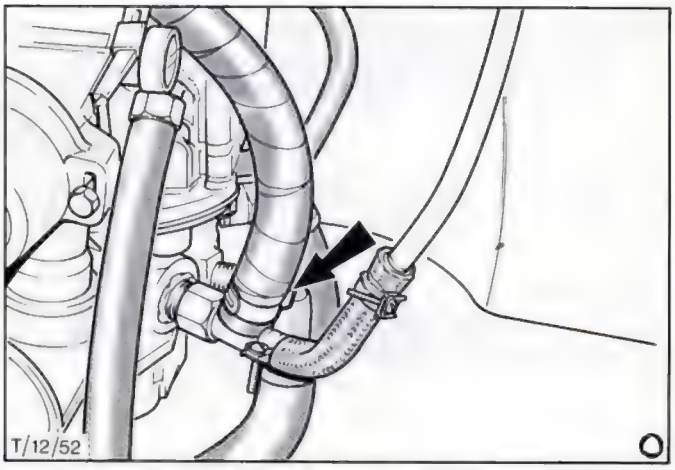


Fig.61. Manifold connection OHC variants.

Diesel variant

Reconnect hoses to vacuum pump, Fig.62.

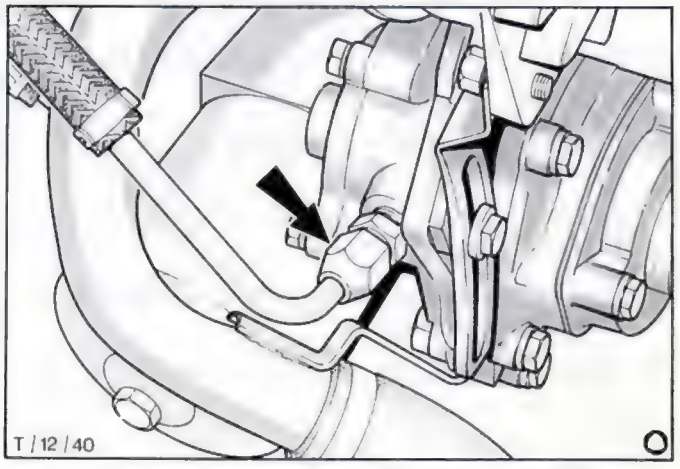


Fig.62. Diesel vacuum hose to pump connection.

12 662 HANDBRAKE - ADJUST

SPECIAL SERVICE TOOLS REQUIRED: NONE

To Adjust

1. Release handbrake lever.

2. Slacken handbrake adjuster by slackening locknuts and rotating adjuster.

3. Apply footbrake to ensure correct auto adjustment.

4. Determine number of teeth on handbrake lever. This can be achieved by pulling the lever up one 'click' and measuring the distance vertically from the lever button to the floor covering. If the distance is more than 200 mm (7,8 in) an eight (8) tooth ratchet is fitted. If the distance is less than 200 mm (7,8 in), an eleven (11) tooth ratchet is fitted.

5. Release lever, pull up lever six (6) 'clicks' on an eleven (11) toothed ratchet and three (3) clicks on the eight toothed ratchet.

6. Tighten adjuster hand tight, rear brakes should just start to bind.

7. Ensure visible threads are equal in length on both sides of the adjuster, and thread is visible through the holes in the adjuster, Fig.64.

8. Tighten adjuster locknuts.

NOTE: After final adjustment the handbrake lever should pull up:

7 to 8 'clicks' for vehicles with eleven teeth, or

4 to 5 'clicks' for vehicles with an 8 tooth ratchet.

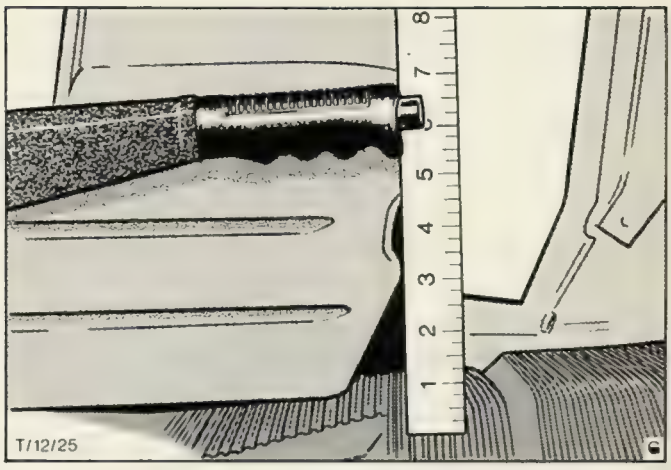


Fig.63. Measure distance between button and floor covering.
7,8 in. = 8 toothed ratchet
less than 7,8 in.= 11 tooth ratchet

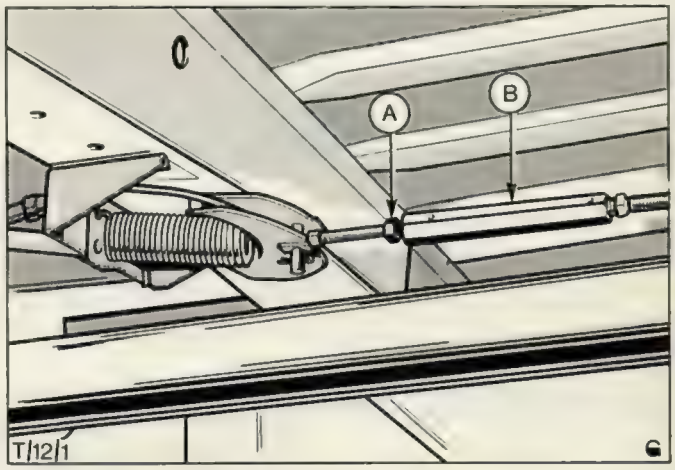


Fig.64. Handbrake adjuster.
A - Locknuts
B - Barrel nut adjuster

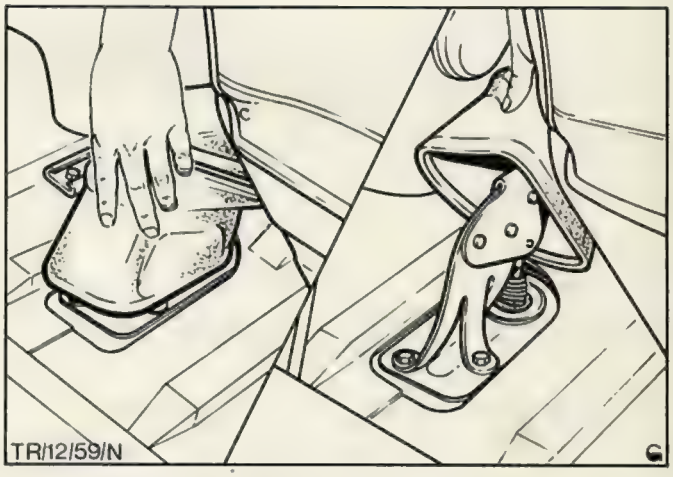


Fig.65. Remove handbrake gaiter.

12 664 LEVER - HANDBRAKE - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS REQUIRED: NONE

To Remove

1. Ensure handbrake lever is in the "off" position.
2. Remove handbrake gaiter from its location around lever mounting bolts, Fig.65.
3. Detach spring clip and clevis from handbrake lever and relay link rod.
4. Remove handbrake lever mounting bolts and remove handbrake (Fig.66).

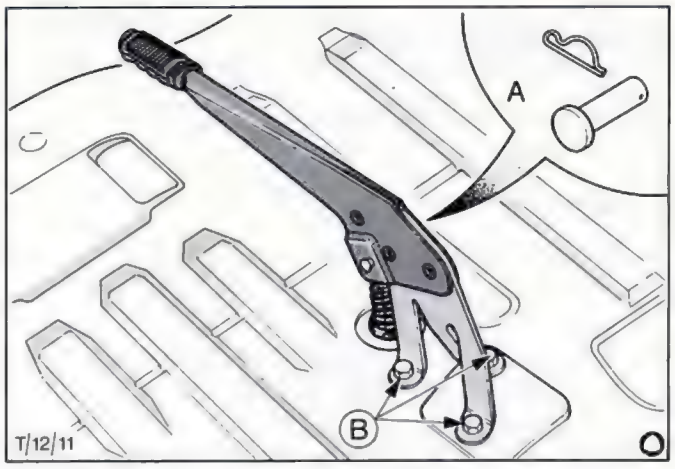


Fig.66. Handbrake mounting bolts.
A - Relay link clevis pin and clip
B - Handbrake mounting bolts

To Install

5. Locate handbrake lever in position on floor and secure.
6. Align relay link rod and handbrake lever, insert clevis pin and spring clip, refit gaiter, Fig.66.
7. Check and if necessary adjust handbrake linkage, refer to Operation 12 662.

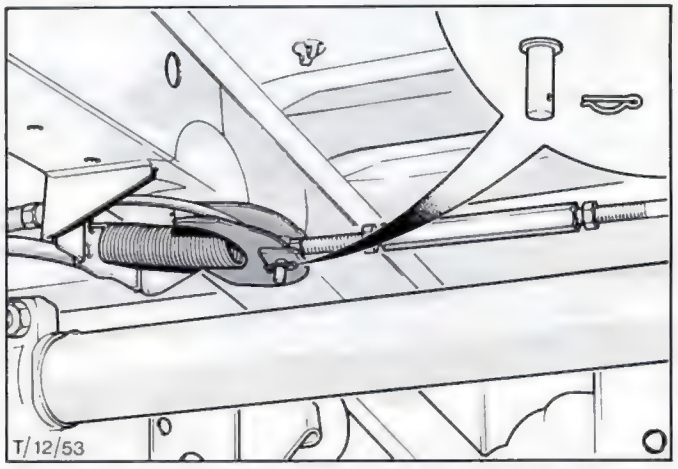


Fig.67. Remove spring clip and clevis pin from equaliser.

12 673 PRIMARY ROD - HANDBRAKE - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS REQUIRED: NONE

To Remove

1. Ensure handbrake is in the "off" position.
2. Remove spring clip and clevis pin securing primary rod to relay lever, Fig.68.
3. Remove spring clip and clevis pin securing primary rod to handbrake cable equaliser, remove primary rod, Fig.67.

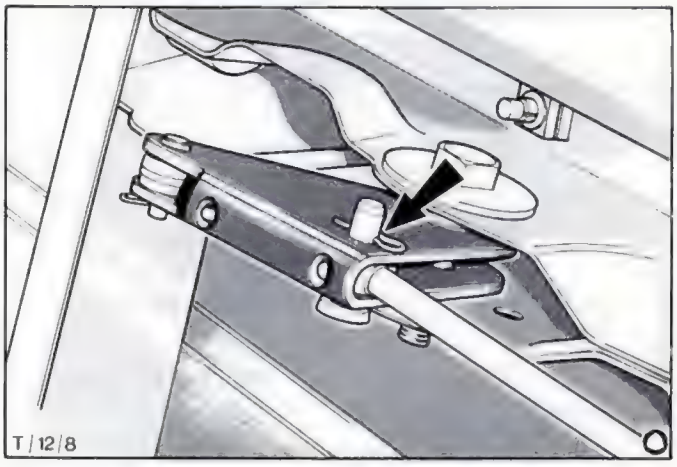


Fig.68. Disconnect primary rod to relay lever.

To Install

4. Align primary rod with relay lever and fit clevis pin and spring clip.
5. Secure other end of primary rod to cable equaliser.
6. Adjust handbrake as described in Operation 12 662.

12 675 REAR CABLE - HANDBRAKE - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS REQUIRED: NONE

To Remove

1. Ensure handbrake is in the "off" position.
2. Remove spring clip and clevis pin from primary rod to equaliser. Remove return spring from equaliser, Fig.69.
3. Remove rear brake drums, refer to Operation 12 285.
4. Remove handbrake cable from operating lever by pulling back spring and unhooking cable.
5. Detach outer cable from brake carrier plates and withdraw cable.
6. Unhook cable from its brackets and remove cable.

To Install

7. Insert cables through carrier plates and hook cables onto operating levers.
8. Fit retaining clips onto outer cables at rear of carrier plates.
9. Insert cable onto equaliser, locate outer cables on equaliser body bracket and fit pull off spring.
10. Secure equaliser to primary rod, fit clevis pin and spring clip.
11. Secure outer cables in body support brackets.
12. Assemble rear brake drums as described in Operation 12 285.
13. Adjust handbrake refer to Operation 12 662.

NOTE: On short wheel base variants, cables cross over each other. Ensure clip is fitted securely, Fig.71.

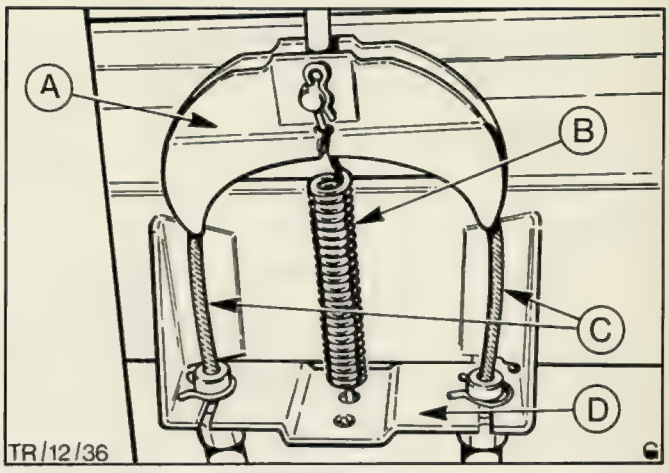


Fig.69. Disconnect equaliser from spring and primary rod.
A - Equaliser
B - Retaining spring
C - Cable
D - Equaliser bracket

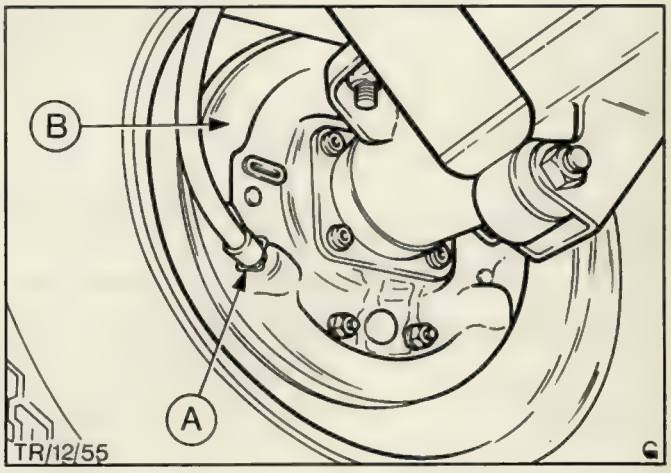


Fig.70. Remove handbrake cable to carrier plate retaining clip.
A - Retaining clip
B - Brake carrier plate

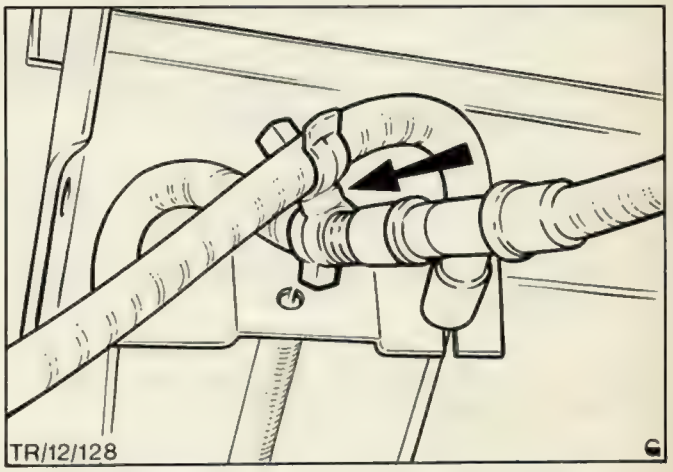


Fig.71. Handbrake cable clip fitted to short wheel base variants.

12 688 BRAKE PRESSURE METERING VALVE - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS REQUIRED: NONE

To Remove

1. Disconnect fluid pipes from metering valve.
2. Remove two nuts securing valve body to bracket, remove valve, Fig.72.

To Install

3. Fit valve and secure, reconnect brake fluid pipes.
4. Bleed brake circuit, refer to Operation 12 141.

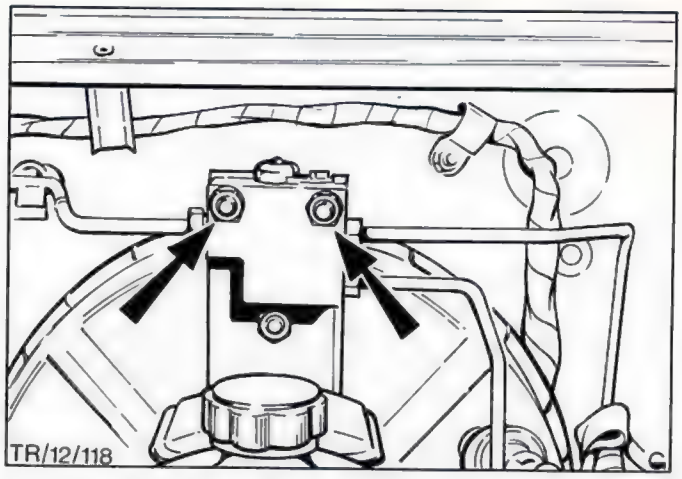


Fig.72. Metering valve mounting to servo bracket.

12 752 LOAD APPORTIONING VALVE - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS REQUIRED: NONE

To Remove

1. Disconnect brake pipes from valve, fit blanking plugs to fluid pipes to prevent excessive fluid loss.
2. Remove spring clip and clevis pin from operating arm and spring.
3. Remove two bolts securing valve bracket to chassis crossmember, and remove valve.

To Install

4. Locate and secure valve bracket to crossmember with two bolts.
5. Reconnect brake fluid pipes and bleed brakes, refer to Operation 12 141.
6. Adjust load apportioning valve as detailed in Operation 12 136.

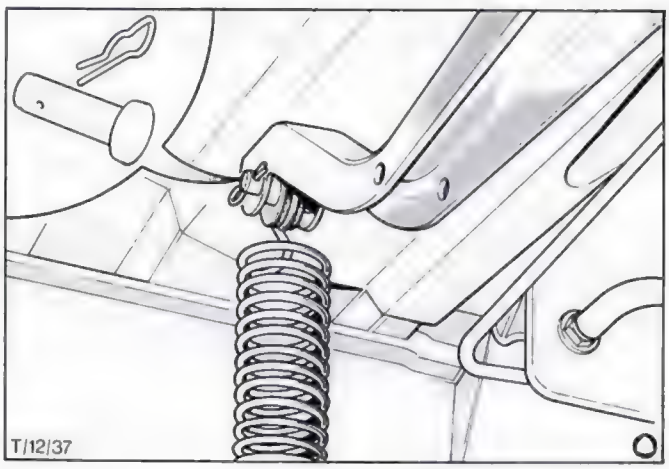


Fig.73. Disconnect spring clevis pin from LAV operating arm.

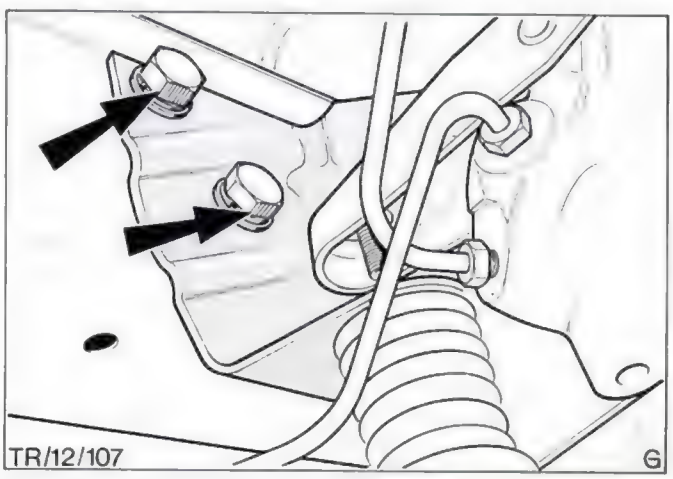


Fig.74. LAV bracket mounting bolts.

12 753 BRACKET AND BUSH ASSEMBLY - L.A.V. REMOVE AND INSTALL

SPECIAL SERVICE TOOLS REQUIRED: NONE

To Remove

1. Carefully slacken nipple locknut, and remove adjusting nipple from end of spring.

CAUTION: LOAD APPORTIONING VALVE SPRING IS UNDER TENSION AND CARE MUST BE TAKEN WHEN SLACKENING NIPPLE LOCK NUT.

2. Remove two bolts securing bracket to rear axle, remove bracket.

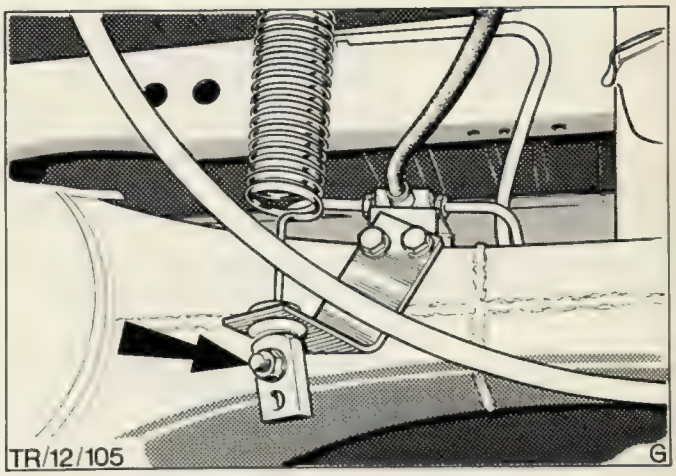


Fig.75. Adjusting nipple and locknut.

To Install

3. Position bracket onto axle casing and secure.

4. Remove spring clip and clevis pin from LAV arm and spring eye.

5. Slide adjusting nipple onto spring tang and tighten only finger tight.

6. Adjust L.A.V. as detailed below:

NOTE: Vehicle MUST be in the unladen condition.

(1) Establish light laden valve 'X' dimension:

a) For STANDARD factory produced bodies this dimension may be read directly from the chart on page 12-35.

b) For chassis cab variants and variants with non-standard bodies

(i) Weigh the vehicle using weighbridge and determine the rear axle weight

(ii) Determine the type of rear suspension designated on the vehicle identification plate

(iii) Read setting from appropriate graph on pages 35 to 45

(2) Push vehicle body down by hand and set dimension in the road spring 'rising' condition.

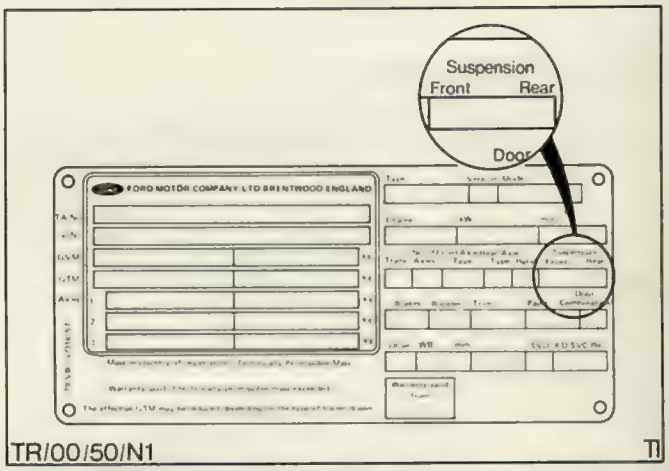


Fig.76. Vehicle identification plate.
'A' Designated - standard suspension
'B' Designated - heavy duty suspension

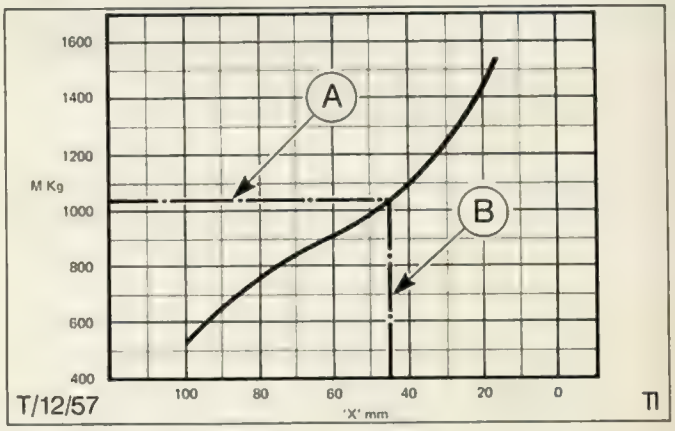


Fig.77. Graph as shown on LAV plate (UK and France).
A - Rear axle unladen weight
B - 'X' dimension setting in mm.

(3) Position spring vertically below operating arm and using tool set the setting dimension. With tool set to dimension 'X', insert tool through clevis pin holes in spring and arm. Mark spring tail with a felt pen or masking tape immediately above bush.

(4) Fit spring to L.A.V. operating lever, and secure with clevis pin and spring clip.

(5) Pull lower end of spring down, passing tail of spring through bush and fit adjustable nipple so that mark on the spring tail is immediately above bush. Secure clamp nut.

(6) If a new spring has been fitted cut off any surplus spring tail below adjustable nipple.

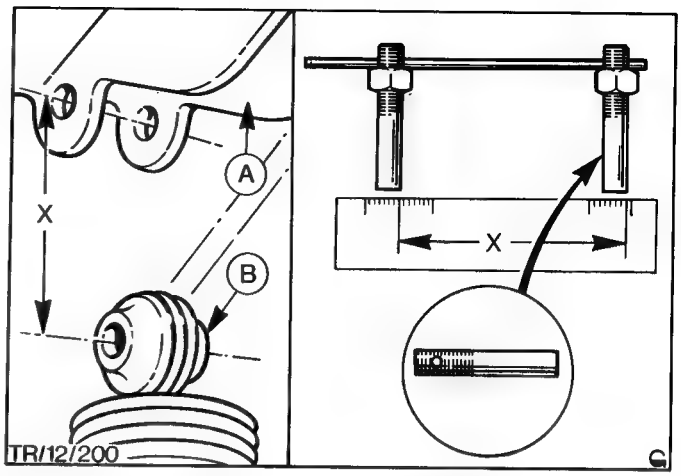


Fig.78. Measuring 'X' dimension/tool for setting dimension 'X'.
A - Arm C - Setting dimension
B - Spring

Tool for setting dimension

A suitable tool can be simply fabricated from lengths of 3 mm and 8 mm diameter rod and two M8 nuts.

Cut 2 x 50 mm lengths of 8 mm rod and chamfer ends.

Drill a 3 mm hole 6 mm from one end of each piece.

Cut M8 threads 20 mm long on same end as drilled holes of each piece.

Cut a 200 mm length of 3 mm rod and assemble as shown in Fig.78.

Adjust tool to setting dimension using a rule as shown.

Lock tool by tightening nuts against rod.

TECHNICAL DATA

LOAD APPORTIONING VALVE SETTING

The following pages, 31 to 44 are to be used when checking or adjusting the Load Apportioning Valve. The specifications and setting procedures are divided into two main categories; those for vehicles with standard factory produced bodies and those for vehicles with specialist bodies. Each of these categories is sub-divided as follows:-

Category A - Vehicles with standard bodies

- Setting dimensions - All standard factory produced bodies except bus and crewbus
- Setting dimensions - All bus and crew bus

Category B - Specialist non-standard produced variants - (bodied and floated - single and double chassis cab - cowls and windshields - vans and kombis with body conversions or modifications)

- Introduction notes for vehicles with specialist bodies
- Information for specialist vehicle body builders
- L.A.V. setting charts for all vehicles built for Germany, Italy, Holland, Denmark, Belgium and Luxembourg only
- L.A.V. setting graphs for variants built for France and U.K. fitted with the graphical type identification plate

Key to 'X' dimension setting charts (pages 35 to 44)

S/CAB = Single cab
D/CAB = Double cab
P = Petrol
D = Diesel
A = Standard level rear suspension
B = Heavy duty rear suspension
(A and B are designated on rating plate)

Category A - Vehicles with standard bodies

- Setting dimensions - All standard factory produced bodies except bus and crewbus

BODY	ENGINE TYPE	80	100	120/ 115	100L	130	150/ 160	175	190
VAN	PETROL	100	100	100	100	105	105* (118)	105	105* (125)
	DIESEL								
PARCEL DELIVERY VAN	PETROL	—	—	95,5	-	-	-	76	-
	DIESEL							95,5	
KOMBI EXCEPT EEC/ECE M1 & SWEDEN, SWISS LCX & AUSTRIA	PETROL	100	100	100	100	109	109* (129)	109	109
	DIESEL	100	100	105	100				
KOMBI # EEC/ECE M1 & SWEDEN & SWISS LCX	PETROL	100	100	100	-	105	-	-	(129)
	DIESEL	105	105	105		-	105		
KOMBI AUSTRIA Only	PETROL	89	89	89	-	-	-	-	-
	DIESEL	100	100	100					

= EXCEPT AUSTRIA * = EXCEPT SWEDEN ( ) = SWEDEN ONLY

TECHNICAL DATA

Category A - Vehicles with standard bodies cont'd

- All bus and crewbus (applicable to both standard and heavy duty suspension)

VEHICLE TYPE	ENGINE TYPE	NUMBER OF SEATS				
		9	12	15	13	17
BUS	PETROL	89	95,5	100*	-	-
	DIESEL	100		(118)		
CREWBUS	PETROL	-	-	-	100	105
	DIESEL					

* = EXCEPT SWEDEN () = SWEDEN ONLY. All other settings are common.

Category B - Specialist non-standard produced variants - (bodied and floated - single and double chassis cab - cowls and windshields - vans and kombis with body conversions or modifications)

- Introduction notes for vehicles with specialist bodies

Category B contains all necessary information for the setting and calculation of the 'X' or 'X' and 'Z' value/dimensions of the load apportioning valve in conjunction with Operation 12 753 of this section. There are two types of LAV identification plates currently fitted, these may be fitted to the left or right hand door step riser. Variants built for sale in Germany, Italy, Holland, Belgium, Denmark, and Luxemburg have a plate depicting 'X'and 'Z' value/dimension. Variants built for the United Kingdom and France have a L.A.V. graphical check plate unique to these markets. All dimensions quoted on these plates are legal check dimensions and are calculated and stamped at plant or by body builders, to comply with the particular territorial legal requirements.

- Information for specialist vehicles body builders only

Vehicles built for Germany, Italy, Holland, Denmark, Belgium, and Luxembourg.

After fitting a specialist body it is necessary to establish and stamp the 'X' or 'X' and 'Z' value/dimensions on the LAV identification plate to comply with local legal requirements (Germany, Italy, Holland, Denmark, Belgium and Luxemburg only). To determine the 'X' dimension at kerb weight, refer to Operation 12 753 page 29 of this section. To establish the value for the 'Z' dimension it is necessary to establish a second 'X' dimension for the vehicle's plated weight. This can be read direct from the appropriate charts or graphs on pages 33 to 45. Once both 'X' dimensions have been established the 'Z' value may be calculated as described below.

'Z' value = 'X' dimension at kerb weight after modification minus 'X' dimension at plated rear axle weight

TECHNICAL DATA

Catergory B - cont'd.

- Information for specialist vehicle body builders only -cont 'd

Example

Model - 80 Body type - Van

Engine - Petrol Rear spring code - 'A'

Rear axle load at kerb weight - 700 kg
Rear axle plated weight - 1170 kg

'X' dimension kerb weight - 90 mm
'X' dimension plated weight - 52 mm

Both of these dimensions have been taken from chart on page 47.

'Z' dimension = Unladen 'X' dimension minus Plated 'X' dimension

= 90 minus 52

= 38 mm

The 'Z' value (dimension) obtained is to be stamped on the L.A.V. identification plate in the appropriate box provided.

NOTE:

Both 'X' and 'Z' dimensions are legal requirements for the particular vehicle variant. Any change or modification affecting kerb weights carried out to the vehicle after the L.A.V. plate has been stamped requires the 'X' and 'Z' dimensions to be rechecked and a new L.A.V. plate fitted and stamped as per the above procedure.

Vehicles built for France and United Kingdom only (with graphical type plate).

For vehicles fitted with the graphical type L.A.V. plate it is not necessary for the 'X' or 'Z' value/dimension to be stamped onto the plate after the conversion or modification has been carried out.

To calculate the correct L.A.V. setting form the graphical type plate the following information must first be obtained:

i - Determine vehicle type and model
ii - Obtain the rear axle unladen weight
iii - Check corresponding graph to L.A.V. plate fitted to the door step riser

Example:

Model 100L. Body type - Van
Engine - Petrol
Rear suspension code 'A'
Rear axle weight - 925 kg
L.A.V. Plate Part Number - 83VB-2L338-BA
'X' dimension from graph 54 mm

MODEL 100L

Body Type - Van & C/Cab

Engine Type - Petrol/Diesel

Spring Type - 'A'

Rear Axle Plated Kg.- 1530

Plate Part Number- 83VB-2L338-BA.

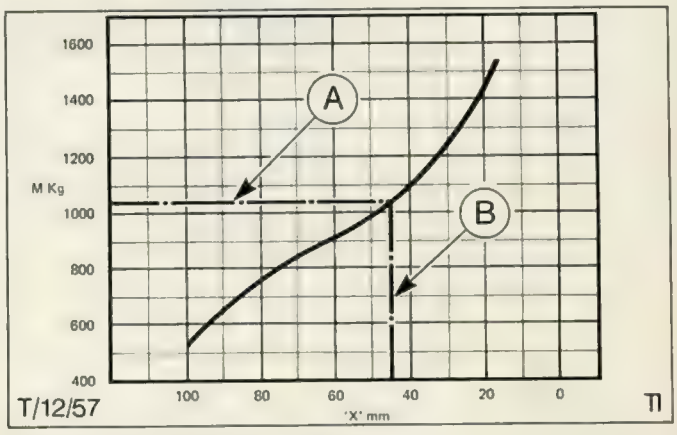


Fig.79. Corresponding graph to L.A.V. plate part.
A - Rear axle weight Kg.
B - L.A.V. setting mm.

TECHNICAL DATA

Specialist non-standard produced variants

(for key to chart see page 31)

MODEL	80	100	100
BODY TYPE	VAN/KOMBI	VAN/KOMBI	S/D CAB
ENGINE TYPE	P/D	P/D	P/D
SPRING TYPE	A/B	A	A
R/AXLE PLATED Kg.		1460	

L.A.V. SET DIM. (mm)	Rear Axle Load at Ground (Kg)
112	408 to 431
110	432 to 456
108	457 to 481
106	482 to 506
104	507 to 531
102	532 to 555
100	556 to 580
98	581 to 605
96	606 to 630
94	631 to 655
92	656 to 679
90	680 to 704
88	705 to 729
86	730 to 754
84	755 to 779
82	780 to 803
80	804 to 828
78	829 to 853
76	854 to 878
74	879 to 903
72	904 to 927
70	928 to 952
68	953 to 977
66	978 to 1002
64	1003 to 1027
62	1028 to 1051
60	1052 to 1076
58	1077 to 1101
56	1102 to 1126
54	1127 to 1151
52	1152 to 1175
50	1176 to 1200
48	1201 to 1225
46	1226 to 1250
44	1251 to 1275
42	1276 to 1299
40	1300 to 1324
38	1325 to 1349
36	1350 to 1374
34	1375 to 1399
32	1400 to 1423
30	1424 to 1448

MODEL	100	100
BODY TYPE	VAN/KOMBI	S/D CAB
ENGINE TYPE	P/D	P/D
SPRING TYPE	B	A
R/AXLE PLATED Kg.		1530

L.A.V. SET DIM. (mm)	Rear Axle Load at Ground (Kg)
115	411 to 428
113	429 to 447
111	448 to 465
109	466 to 483
107	484 to 502
105	503 to 520
103	521 to 539
101	540 to 557
99	558 to 575
97	576 to 594
95	595 to 613
93	614 to 633
91	634 to 653
89	654 to 673
87	674 to 693
85	694 to 713
83	714 to 733
81	734 to 753
79	754 to 773
77	774 to 793
75	794 to 813
73	814 to 833
71	834 to 853
69	854 to 874
67	875 to 895
65	896 to 917
63	918 to 938
61	939 to 960
59	961 to 981
57	982 to 1003
55	1004 to 1026
53	1027 to 1048
51	1049 to 1071
49	1072 to 1094
47	1095 to 1117
45	1118 to 1140
43	1141 to 1163
41	1164 to 1190
39	1191 to 1218
37	1219 to 1246
35	1247 to 1274
33	1275 to 1302
31	1303 to 1330
29	1331 to 1358
27	1359 to 1386
25	1387 to 1414
23	1415 to 1442
21	1443 to 1472
19	1473 to 1502

TECHNICAL DATA

(for key to chart see page 31)

MODEL	120	120	100
BODY TYPE	VAN/KOMBI	S/D CAB	S/D CAB
ENGINE TYPE	P/D	P/D	P/D
SPRING TYPE	A/B	A/B	B
R/AXLE PLATED Kg.		1650	

L.A.V. SET DIM. (mm)	Rear Axle Load at Ground (Kg)
115	411 to 428
113	429 to 447
111	448 to 466
109	467 to 484
107	485 to 503
105	504 to 522
103	523 to 541
101	542 to 559
99	560 to 578
97	579 to 599
95	600 to 620
93	621 to 641
91	642 to 662
89	663 to 683
87	684 to 704
85	705 to 725
83	726 to 745
81	746 to 766
79	767 to 787
77	788 to 809
75	810 to 833
73	834 to 857
71	858 to 882
69	883 to 906
67	907 to 931
65	932 to 955
63	956 to 980
61	981 to 1004
59	1005 to 1029
57	1030 to 1057
55	1058 to 1086
53	1087 to 1114
51	1115 to 1143
49	1144 to 1171
47	1172 to 1199
45	1200 to 1228
43	1229 to 1256
41	1257 to 1285
39	1286 to 1317
37	1318 to 1352
35	1353 to 1387
33	1388 to 1422
31	1423 to 1457
29	1458 to 1492
27	1493 to 1527
25	1528 to 1562
23	1563 to 1599
21	1600 to 1638

MODEL	100	
BODY TYPE	VAN/KOMBI	S/D CAB
ENGINE TYPE	P/D	
SPRING TYPE	A	
R/AXLE PLATED Kg.	1530	

L.A.V. SET DIM. (mm)	Rear Axle Load at Ground (Kg)
110	462 to 473
108	474 to 486
106	487 to 499
104	500 to 512
102	513 to 525
100	526 to 538
98	539 to 551
96	552 to 564
94	565 to 577
92	578 to 590
90	591 to 603
88	604 to 616
86	617 to 629
84	630 to 642
82	643 to 655
80	656 to 668
78	669 to 681
76	682 to 694
74	695 to 707
72	708 to 720
70	721 to 733
68	734 to 745
66	746 to 758
64	759 to 771
62	772 to 784
60	785 to 797
58	798 to 810
56	811 to 823
54	824 to 840
52	841 to 857
50	858 to 875
48	876 to 892
46	893 to 909
44	910 to 931
42	932 to 953
40	954 to 975
38	976 to 997
36	998 to 1019
34	1020 to 1046
32	1047 to 1074
30	1075 to 1102
28	1103 to 1130
26	1131 to 1158
24	1159 to 1187
22	1188 to 1215
20	1216 to 1243
18	1244 to 1272
16	1273 to 1300
14	1301 to 1346
12	1347 to 1394
10	1395 to 1441
8	1442 to 1488

TECHNICAL DATA

(for key to chart see page 31)

MODEL	130	160
BODY TYPE	VAN - S/D CAB	VAN - S/CAB
ENGINE TYPE	P/D	P/D
SPRING TYPE	B	A
R/AXLE PLATED Kg.	2240	

L.A.V. SET DIM. (mm)	Rear Axle Load at Ground (Kg)
120	541 to 562
118	563 to 584
116	585 to 607
114	608 to 629
112	630 to 651
110	652 to 674
108	675 to 697
106	698 to 723
104	724 to 750
102	751 to 776
100	777 to 802
98	803 to 828
96	829 to 855
94	856 to 881
92	882 to 907
90	908 to 933
88	934 to 960
86	961 to 986
84	987 to 1012
82	1013 to 1041
80	1042 to 1070
78	1071 to 1100
76	1101 to 1129
74	1130 to 1158
72	1159 to 1188
70	1189 to 1217
68	1218 to 1247
66	1248 to 1276
64	1277 to 1305
62	1306 to 1340
60	1341 to 1375
58	1376 to 1411
56	1412 to 1446
54	1447 to 1482
52	1483 to 1522
50	1523 to 1563
48	1564 to 1604
46	1605 to 1645
44	1646 to 1686
42	1687 to 1727
40	1728 to 1768
38	1769 to 1812
36	1813 to 1861
34	1862 to 1910
32	1911 to 1960
30	1961 to 2009
28	2010 to 2058
26	2059 to 2108
24	2109 to 2157
22	2158 to 2207

MODEL	130	160
BODY TYPE	KOMBI	KOMBI
ENGINE TYPE	P/D	P/D
SPRING TYPE	B	A
R/AXLE PLATED Kg.	2240	

L.A.V. SET DIM. (mm)	Rear Axle Load at Ground (Kg)
111	705 to 730
109	731 to 756
107	757 to 783
105	784 to 809
103	810 to 835
101	836 to 861
99	862 to 888
97	889 to 914
95	915 to 940
93	941 to 966
91	967 to 993
89	994 to 1019
87	1020 to 1048
85	1049 to 1078
83	1079 to 1107
81	1108 to 1136
79	1137 to 1166
77	1167 to 1195
75	1196 to 1225
73	1226 to 1254
71	1255 to 1283
69	1284 to 1313
67	1314 to 1349
65	1350 to 1384
63	1385 to 1420
61	1421 to 1455
59	1456 to 1491
57	1492 to 1532
55	1533 to 1573
53	1574 to 1614
51	1615 to 1655
49	1656 to 1697
47	1698 to 1738
45	1739 to 1779
43	1780 to 1824
41	1825 to 1874
39	1875 to 1923
37	1924 to 1972
35	1973 to 2022
33	2023 to 2071
31	2072 to 2120
29	2121 to 2170
27	2171 to 2219

TECHNICAL DATA

(for key to chart see page 31)

MODEL	130
BODY TYPE	VAN - S/D CAB
ENGINE TYPE	P/D
SPRING TYPE	A
R/AXLE PLATED Kg.	2020

L.A.V. SET DIM. (mm)	Rear Axle Load at Ground (Kg)
121	542 to 561
119	562 to 581
117	582 to 601
115	602 to 621
113	622 to 641
111	642 to 661
109	662 to 681
107	682 to 701
105	702 to 720
103	721 to 740
101	741 to 760
99	761 to 780
97	781 to 800
95	801 to 820
93	821 to 841
91	842 to 865
89	866 to 889
87	890 to 913
85	914 to 937
83	938 to 961
81	962 to 985
79	986 to 1009
77	1010 to 1034
75	1035 to 1061
73	1062 to 1087
71	1088 to 1114
69	1115 to 1141
67	1142 to 1167
65	1168 to 1194
63	1195 to 1221
61	1222 to 1254
59	1255 to 1286
57	1287 to 1318
55	1319 to 1350
53	1351 to 1383
51	1384 to 1415
49	1416 to 1447
47	1448 to 1482
45	1483 to 1520
43	1521 to 1557
41	1558 to 1594
39	1595 to 1631
37	1632 to 1674
35	1675 to 1721
33	1722 to 1768
31	1769 to 1814
29	1815 to 1861
27	1862 to 1908
25	1909 to 1954
23	1955 to 2001

MODEL	130	160
BODY TYPE	VAN S/D CAB	VAN - S/CAB
ENGINE TYPE	P/D	P/D
SPRING TYPE	B	A
R/AXLE PLATED Kg.	2020	

L.A.V. SET DIM. (mm)	Rear Axle Load at Ground (Kg)
112	708 to 727
110	728 to 747
108	748 to 767
106	768 to 787
104	788 to 807
102	808 to 827
100	828 to 848
98	849 to 872
96	873 to 896
94	897 to 920
92	921 to 944
90	945 to 968
88	969 to 992
86	993 to 1016
84	1017 to 1043
82	1044 to 1069
80	1070 to 1096
78	1097 to 1123
76	1124 to 1149
74	1150 to 1176
72	1177 to 1203
70	1204 to 1232
68	1233 to 1264
66	1265 to 1296
64	1297 to 1329
62	1330 to 1361
60	1362 to 1393
58	1394 to 1425
56	1426 to 1458
54	1459 to 1495
52	1496 to 1532
50	1533 to 1569
48	1570 to 1606
46	1607 to 1643
44	1644 to 1689
42	1690 to 1736
40	1737 to 1783
38	1784 to 1830
36	1831 to 1876
34	1877 to 1923
32	1924 to 1970
30	1971 to 2016

TECHNICAL DATA

(for key to chart see page 31)

MODEL	160	175
BODY TYPE	VAN - S/D CAB	VAN - S/CAB
ENGINE TYPE	P/D	P/D
SPRING TYPE	B	A
R/AXLE PLATED Kg.	2330	

L.A.V. SET DIM. (mm)	Rear Axle Load at Ground (Kg)
119	554 to 567
117	568 to 591
115	592 to 615
113	616 to 639
111	640 to 663
109	664 to 689
107	690 to 716
105	717 to 744
103	745 to 771
101	772 to 799
99	800 to 827
97	828 to 854
95	855 to 882
93	883 to 909
91	910 to 937
89	938 to 966
87	967 to 997
85	998 to 1028
83	1029 to 1059
81	1060 to 1091
79	1092 to 1122
77	1123 to 1153
75	1154 to 1184
73	1185 to 1221
71	1222 to 1259
69	1260 to 1297
67	1298 to 1334
65	1335 to 1372
63	1373 to 1410
61	1411 to 1448
59	1449 to 1488
57	1489 to 1531
55	1532 to 1574
53	1575 to 1617
51	1618 to 1660
49	1661 to 1705
47	1706 to 1755
45	1756 to 1804
43	1805 to 1853
41	1854 to 1902
39	1903 to 1954
37	1955 to 2012
35	2013 to 2071
33	2072 to 2129
31	2130 to 2187
29	2188 to 2245
27	2246 to 2303

MODEL	160
BODY TYPE	KOMBI
ENGINE TYPE	P/D
SPRING TYPE	B
R/AXLE PLATED Kg.	2330

L.A.V. SET DIM. (mm)	Rear Axle Load at Ground (Kg)
110	707 to 734
108	735 to 761
106	762 to 789
104	790 to 817
102	818 to 844
100	845 to 872
98	873 to 899
96	900 to 927
94	928 to 955
92	956 to 986
90	987 to 1017
88	1018 to 1048
86	1049 to 1079
84	1080 to 1110
82	1111 to 1142
80	1143 to 1173
78	1174 to 1207
76	1208 to 1245
74	1246 to 1283
72	1284 to 1321
70	1322 to 1358
68	1359 to 1396
66	1397 to 1434
64	1435 to 1472
62	1473 to 1515
60	1516 to 1558
58	1559 to 1601
56	1602 to 1645
54	1646 to 1688
52	1689 to 1737
50	1738 to 1786
48	1787 to 1835
46	1836 to 1884
44	1885 to 1934
42	1935 to 1991
40	1992 to 2049
38	2050 to 2108
36	2109 to 2166
34	2167 to 2224
32	2225 to 2282

TECHNICAL DATA

(for key to chart see page 31)

MODEL	175	190
BODY TYPE	VAN - S/CAB	VAN - S/D CAB
ENGINE TYPE	P/D	P/D
SPRING TYPE	B	A
R/AXLE PLATED Kg.	2600	

L.A.V. SET DIM. (mm)	Rear Axle Load at Ground (Kg)
119	551 to 576
117	577 to 603
115	604 to 629
113	630 to 656
111	657 to 682
109	683 to 709
107	710 to 741
105	742 to 777
103	778 to 812
101	813 to 847
99	848 to 883
97	884 to 918
95	919 to 955
93	956 to 997
91	998 to 1039
89	1040 to 1081
87	1082 to 1123
85	1124 to 1166
83	1167 to 1212
81	1213 to 1258
79	1259 to 1304
77	1305 to 1350
75	1351 to 1397
73	1398 to 1453
71	1454 to 1509
69	1510 to 1565
67	1566 to 1621
65	1622 to 1678
63	1679 to 1738
61	1739 to 1798
59	1799 to 1858
57	1859 to 1918
55	1919 to 1980
53	1981 to 2050
51	2051 to 2120
49	2121 to 2190
47	2191 to 2260
45	2261 to 2330
43	2331 to 2401
41	2402 to 2476
39	2477 to 2551

MODEL	190
BODY TYPE	KOMBI
ENGINE TYPE	P/D
SPRING TYPE	A
R/AXLE PLATED Kg.	2600

L.A.V. SET DIM. (mm)	Rear Axle Load at Ground (Kg)
109	736 to 771
107	772 to 806
105	807 to 841
103	842 to 877
101	878 to 912
99	913 to 948
97	949 to 990
95	991 to 1032
93	1033 to 1074
91	1075 to 1116
89	1117 to 1158
87	1159 to 1204
85	1205 to 1250
83	1251 to 1296
81	1297 to 1342
79	1343 to 1388
77	1389 to 1444
75	1445 to 1500
73	1501 to 1556
71	1557 to 1612
69	1613 to 1668
67	1669 to 1728
65	1729 to 1788
63	1789 to 1848
61	1849 to 1908
59	1909 to 1968
57	1969 to 2038
55	2039 to 2108
53	2109 to 2178
51	2179 to 2248
49	2249 to 2318
47	2319 to 2388
45	2389 to 2463
43	2464 to 2538

TECHNICAL DATA

Specialist non-standard produced variants France and U.K. only

(for key to chart see page 31)

MODEL: 160

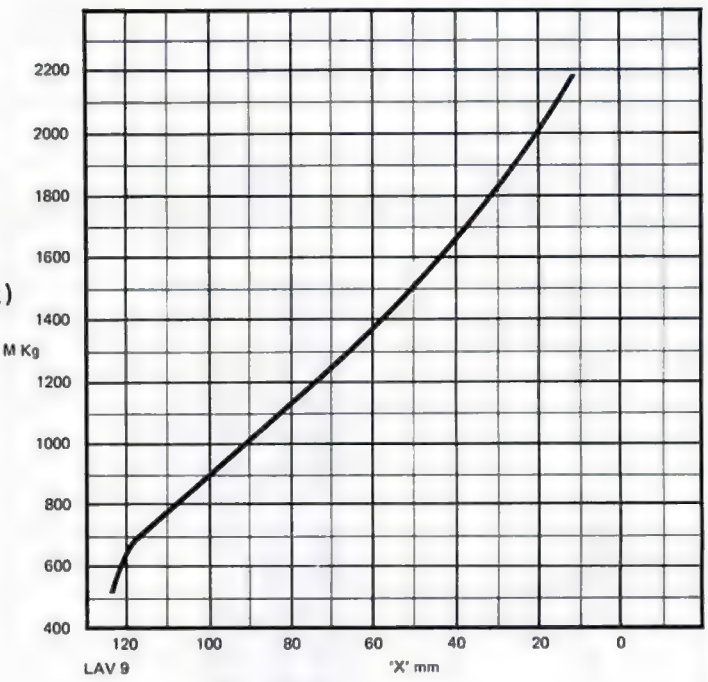
BODY TYPE: CHASSIS WINDSCREEN VAN FLOOR AND CHASSIS COWL VAN FLOOR FOR AMBULANCE CONVERSION

ENGINE TYPE: PETROL (2,0L OHC/ 3,0L Essex)

SPRING TYPE: SN (SVE AMBULANCE SUSPENSION)

R/AXLE PLATED Kg. 2240

L.A.V. Identification Plate
Part Number: V83VB-2L338-AA



MODEL 80 100 120

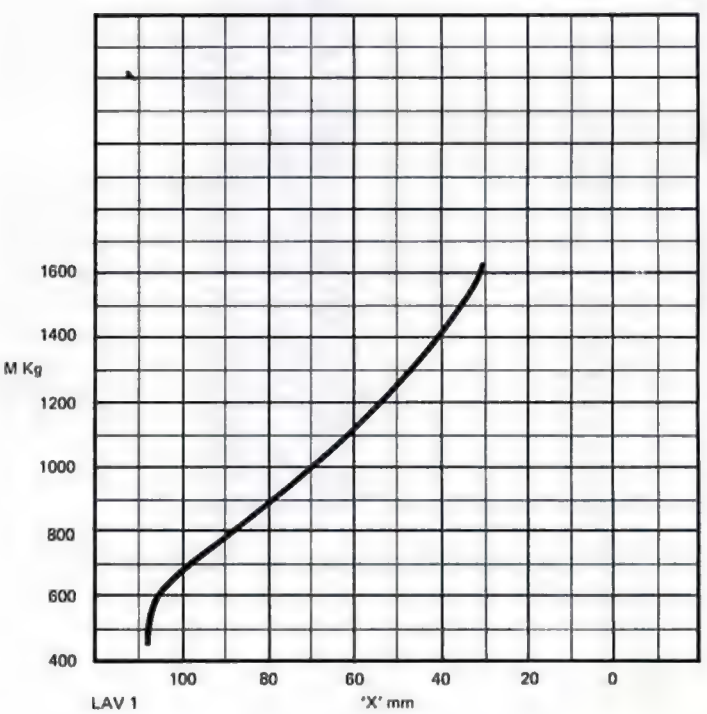
BODY TYPE VAN/KOMBI D/S CHASSIS CAB

ENGINE TYPE Petrol / Diesel

SPRING TYPE A/B

R/AXLE PLATED Kg. 1170/1460/1530/1590/1650

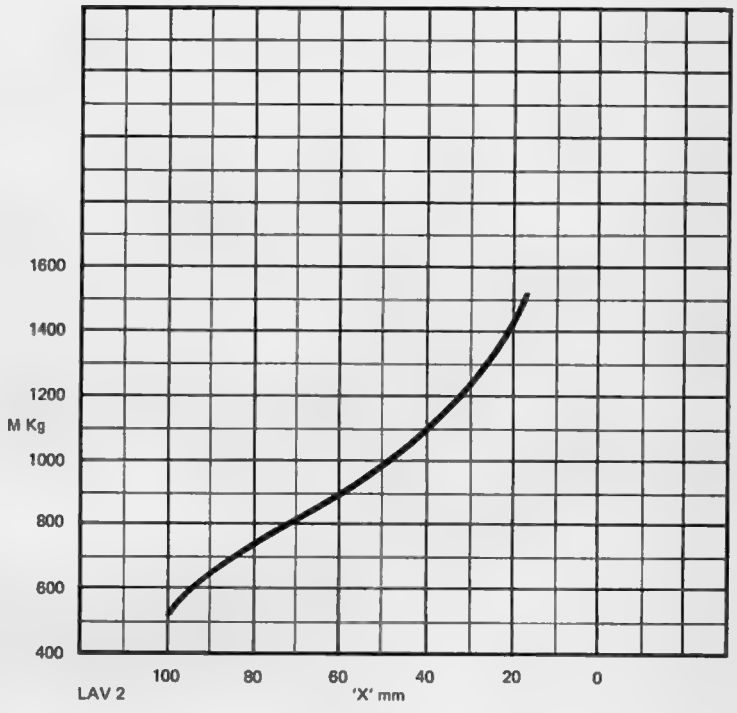
L.A.V. Identification Plate
Part Number: 83VB-2L338-AA



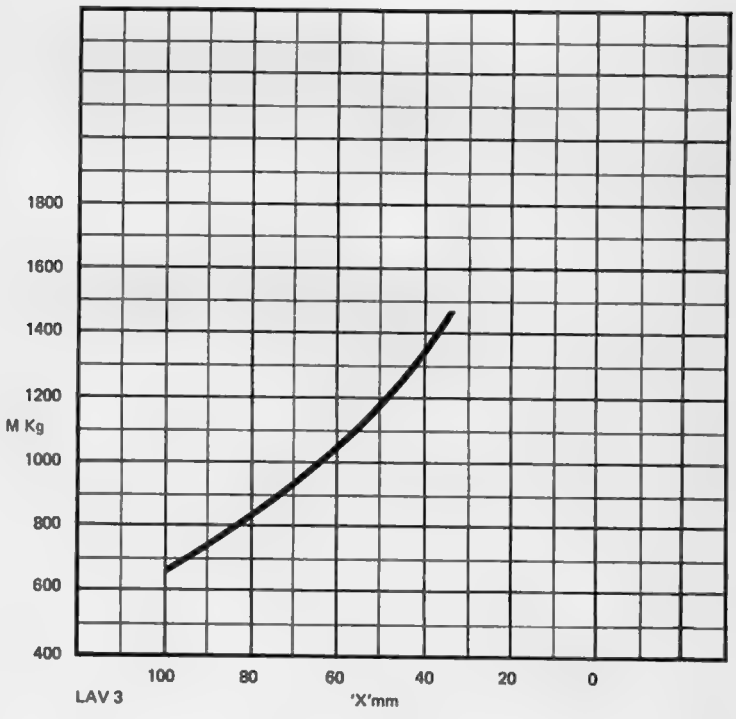
TECHNICAL DATA

(for key to chart see page 31)

MODEL:	100L
BODY TYPE:	VAN & C/CAB
ENGINE TYPE:	Petrol/Diesel
SPRING TYPE:	A
R/AXLE PLATED Kg.	1530
L.A.V. Identification Plate Part Number:	83VB-2L338-BA



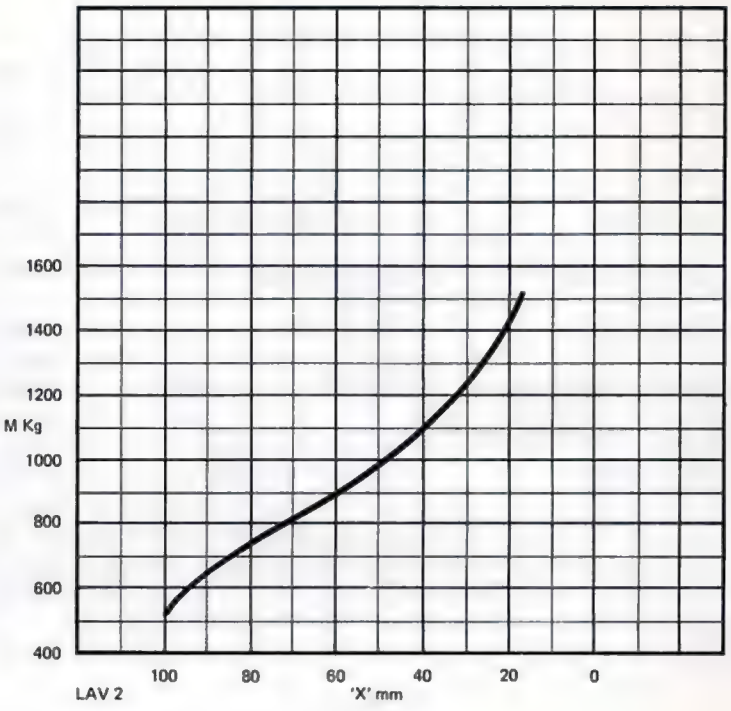
MODEL:	100L
BODY TYPE:	KOMBI
ENGINE TYPE:	Petrol/Diesel
SPRING TYPE:	A
R/AXLE PLATED Kg.	1530
L.A.V. Identification Plate Part Number:	83VB-2L338-CA



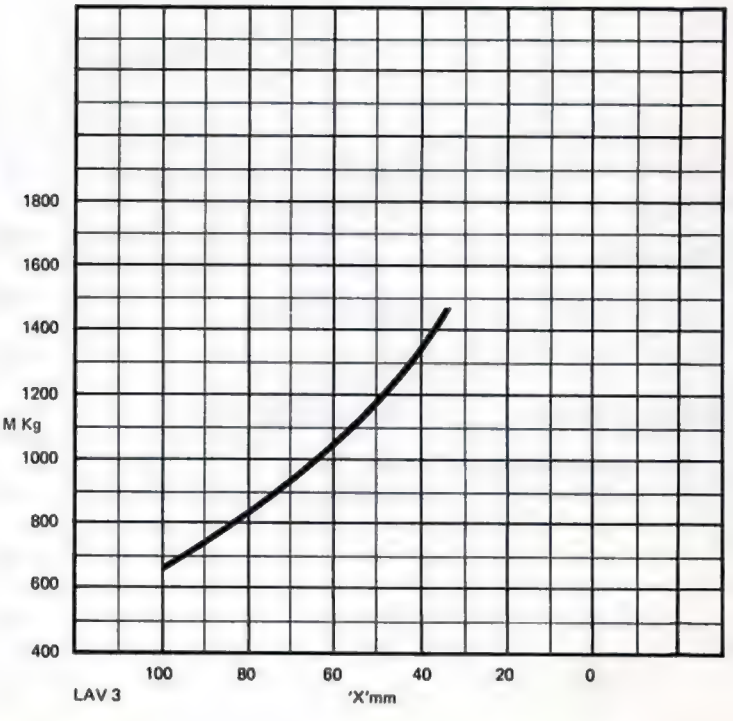
TECHNICAL DATA

(for key to chart see page 31)

MODEL:	100L
BODY TYPE:	VAN & C/CAB
ENGINE TYPE:	Petrol/Diesel
SPRING TYPE:	A
R/AXLE PLATED Kg.	1530
L.A.V. Identification Plate Part Number:	83VB-2L338-BA



MODEL:	100L
BODY TYPE:	KOMBI
ENGINE TYPE:	Petrol/Diesel
SPRING TYPE:	A
R/AXLE PLATED Kg.	1530
L.A.V. Identification Plate Part Number:	83VB-2L338-CA

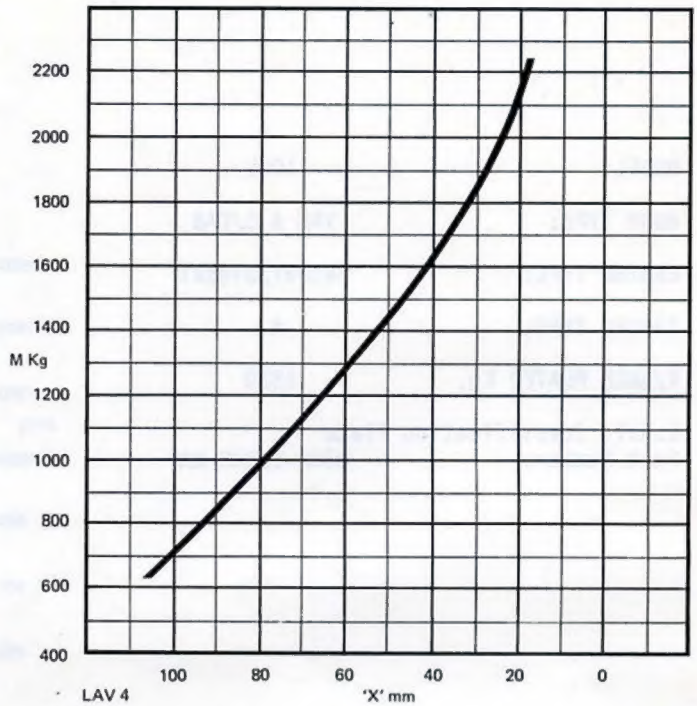


TECHNICAL DATA

(for key to chart see page 31)

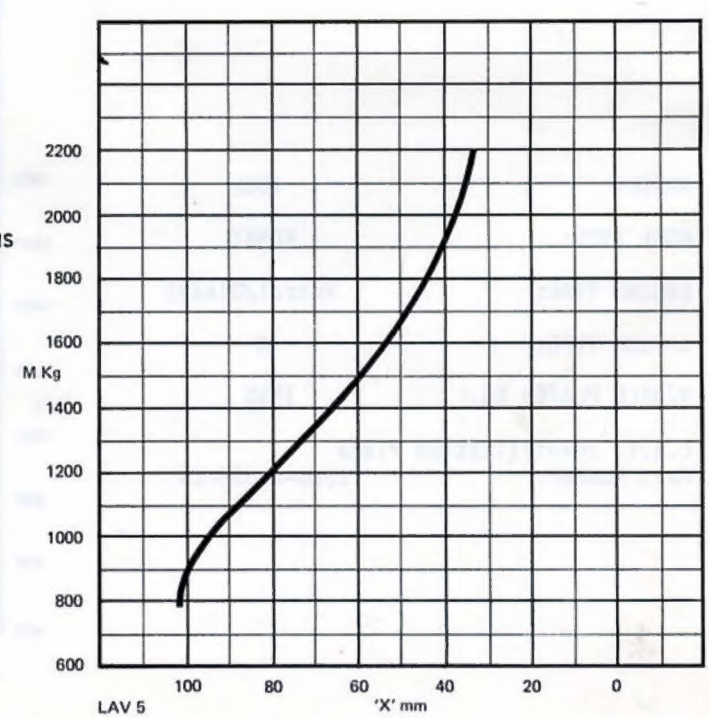
MODEL:	130	160	175
BODY TYPE:	Van	D/S Chassis Cab	
ENGINE TYPE:	Petrol/Diesel		
SPRING TYPE:	A/B		A
R/AXLE PLATED Kg.	2020/2240		2300

L.A.V. Identification Plate
Part Number: 83VB-2L338-DA



MODEL:	130/160
BODY TYPE:	KOMBI 15 seat bus 17 seat crew bus
ENGINE TYPE:	Petrol/Diesel
SPRING TYPE:	A/B
R/AXLE PLATED Kg.	2020 2240

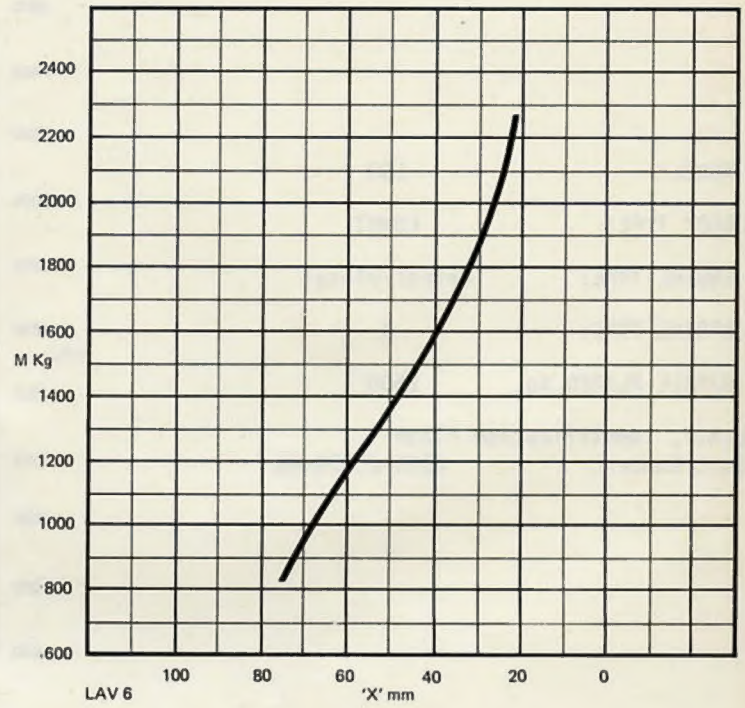
L.A.V. Identification Plate
Part Number: 83VB-2L338-EA



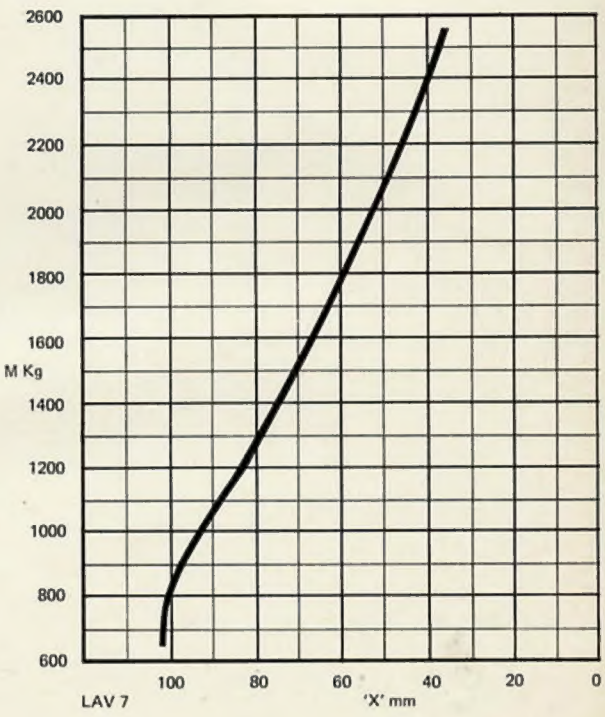
TECHNICAL DATA

(for key to chart see page 31)

MODEL:	175
BODY TYPE:	Parcel Delivery Van
ENGINE TYPE:	Petrol
SPRING TYPE:	B
R/AXLE PLATED Kg.	2330
L.A.V. Identification Plate Part Number:	83VB-2L338-FA



MODEL:	175	175	190
BODY TYPE:	Vans - Chassis Cab	PDV	Van D/S Chassis Cab
ENGINE TYPE:	Petrol/Diesel	Diesel	Petrol/Diesel
SPRING TYPE:	B	B	A
R/AXLE PLATED Kg.	2330	2330	2600
L.A.V. Identification Plate Part Number:		83VB-2L338-GA	

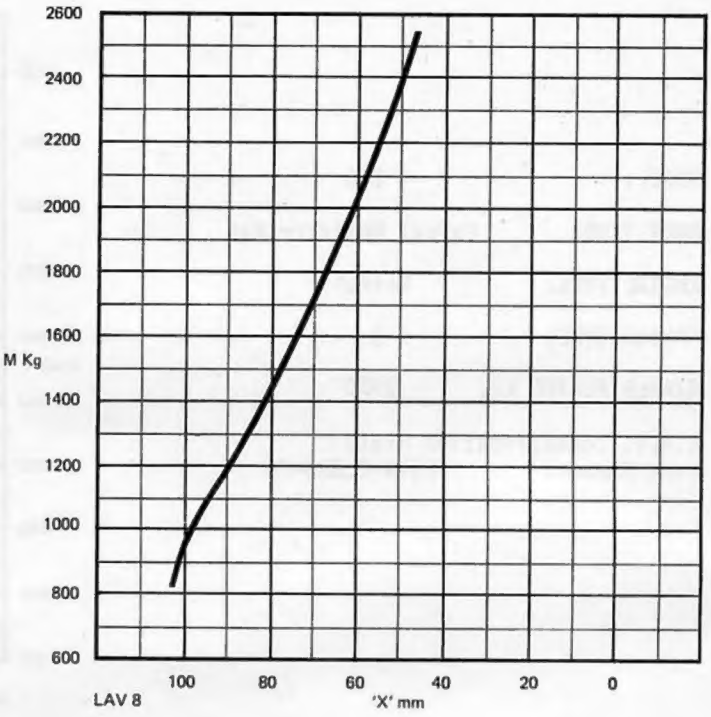


TECHNICAL DATA

(for key to chart see page 31)

MODEL:	190
BODY TYPE:	KOMBI
ENGINE TYPE:	Petrol/Diesel
SPRING TYPE:	A
R/AXLE PLATED Kg.	2600

L.A.V. Identification Plate
Part Number: 83VB-2L338-HA



TECHNICAL DATA

System	Dual line, split either vertically or horizontally
Type	Front disc/caliper, rear drum/shoe
Handbrake	Rod/Cable operation. Manual adjustment, handbrake operation on rear wheels only

Front Brakes

Disc diameter mm (in) - inner outer	270 (10,62) 156 (6,14)
Disc thickness mm (in) (solid)	14,15 (0,55)
Disc thickness mm (in) (ventilated)	23,90 (0,94)
Disc run out (including hub) mm (in)	0,13 (0,005)
Piston bore diameter mm (in)	57,15 (2,25) 41,40 (1,63)
Pad area (both wheels) cm^2 (in^2)	154,83 (24,00) 193,54 (30,00)
Pad material	Ferodo 2430

Rear Brakes

Drum diameter mm (in)	228,6 (9,00) 254,0 (10,00)
Shoe width mm (in)	44,4 (1,75) 57,1 (2,25) 69,8 (2,75)
Wheel cylinder diameter mm (in)	20,3 (0,8) 22,2 (0,87) 23,8 (0,93)
Lining material	Ferodo FF616 Ferodo AM14

Lubricant

General Grease	EM-1C-18

Tightening Torques

	Nm.	Kgf.m	lbf.ft
Caliper to front suspension unit	90 to 110	9,0 to 11,0	66 to 81
Carrier plate to axle housing	30 to 35	3,0 to 3,5	22 to 25
Hydraulic unions	12,0 to 15,0	1,2 to 1,5	8 to 11
Bleed valves - sufficient to seal	10,2 max	1,0 max	8 max